GEOLOGICAL SURVEY OF CANADA

OPEN FILE 3863

Till geochemistry, Rideout Island and Elu Inlet map areas, Nunavut (NTS 76-O, N/2; 77A, SW/4)

D.E. Kerr, R.D. Knight, T. Kyer

2000

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Contribution to the Slave NATMAP Project
Contribution au Project de la Province des Esclaves du CARTNAT

2000

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INTRODUCTION

Purpose

The Quaternary geology component of the Slave Province National Mapping Program was designed to provide a regional framework for geologic interpretation, environmental management, and drift prospecting. In 1997, Terrain Sciences Division of the Geological Survey of Canada (GSC) mapped the surficial geology of the northern Rideout Island and southwest quadrant of the Elu Inlet map areas (NTS 76O, 77A) (Figure 1). The project involved helicopter-assisted ground work including surficial geology mapping, till sampling, and measuring of ice flow indicators. A total of 95 1-kg samples from the study area were collected for elemental geochemical analysis (Figure 2). At each till sample site, pebbles were collected and classified according to their lithology to assess glacial transport distances. The purposes of this report are (1) to release regional geochemical data; (2) to summarize information on surficial materials and glacial history that is relevant to the interpretation of the geochemical data; and (3) to establish regional background concentrations of selected trace and minor elements for mineral exploration and environmental baseline studies. Interpretive Quaternary geology report and surficial geology map, complementary to this Open File, have been published separately (Kerr et al. 1998a, b). Notes on the glacial geology of the area can also be found in Blake (1963),

The Open File includes the following: 1) regional bedrock and Quaternary geological settings; 2) sample location information (Appendix A); 3) results of geochemical analyses of the < 0.002 mm (clay) fraction analyzed by inductively coupled plasma - atomic emission spectrometry (ICP-AES) (Appendix B), and the < 0.063 mm (silt+clay) fraction analyzed by instrumental neutron activation analysis (INAA) (Appendix C); 4) quality control data relating to standard and duplicate samples (Appendices D and E); 5) summary statistics and histograms; and 6) proportional dot maps showing distributions of concentrations of selected elements (Appendices F and G).

The text, figures, maps and histograms, and geochemical data of this document are available on CD-ROM in Adobe Acrobat 3.01 and Excel 4.0, respectively.

Location and physiography

The Rideout Island/Elu Inlet map area (Figure 1) lies in the north-central District of Mackenzie. Elevations range from 0 m (present-day sea level) to 319 m in the Buchan and Naujaat Hills in the northwestern regions. The terrain in the western half of the map area rises abruptly inland from the coast southward and eastward, and averages 100-200 m in elevation. Much of the area in the eastern regions, including the Koignuk River valley, is <50-100 m, with the notable exception of the northeastern-most regions where elevations reach 160 m. Local relief is variable, commonly between <5 m and 15 m in areas of outcrop and marine sediments, although relief >100 m occurs in rocky areas of

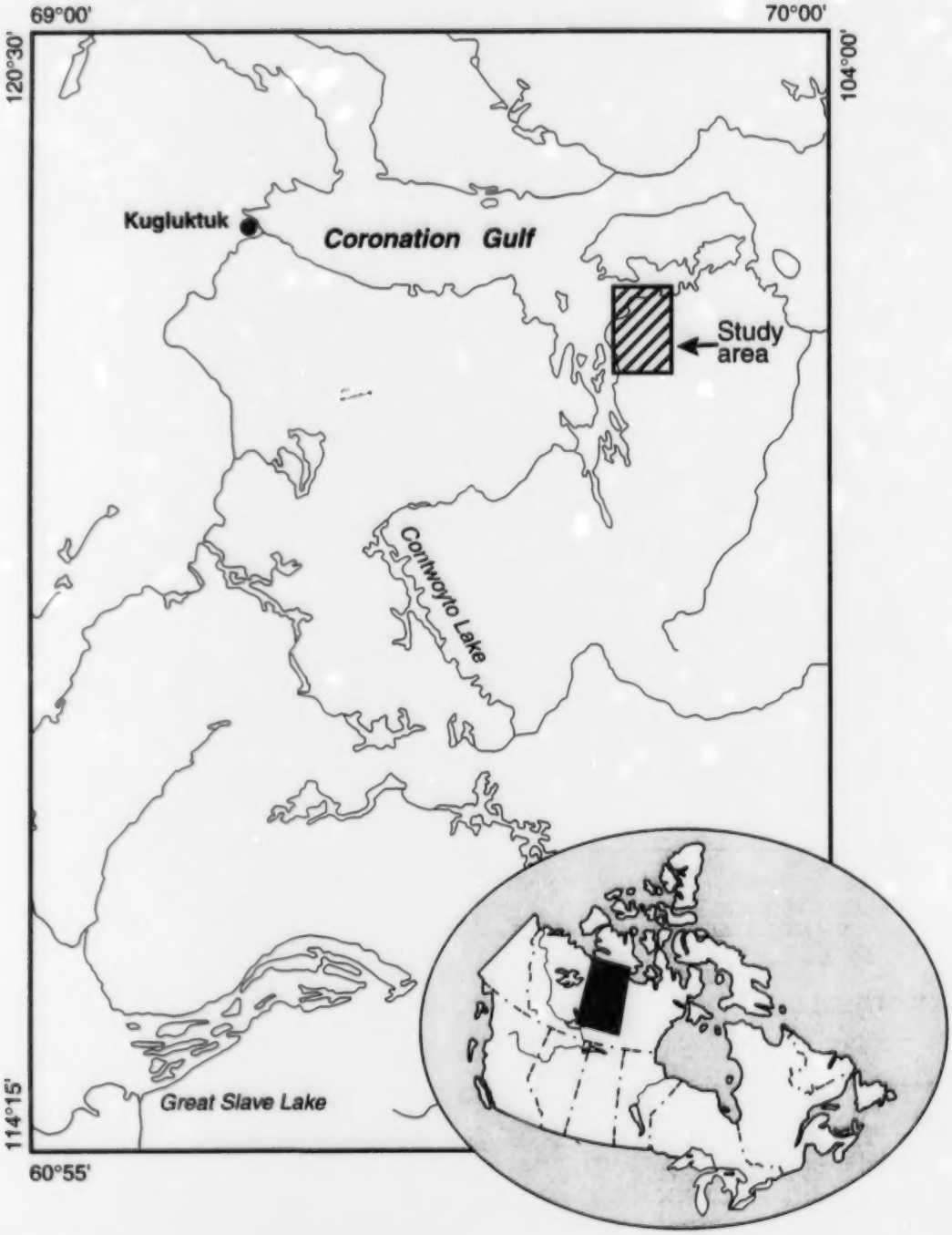

Figure 1. Location map.

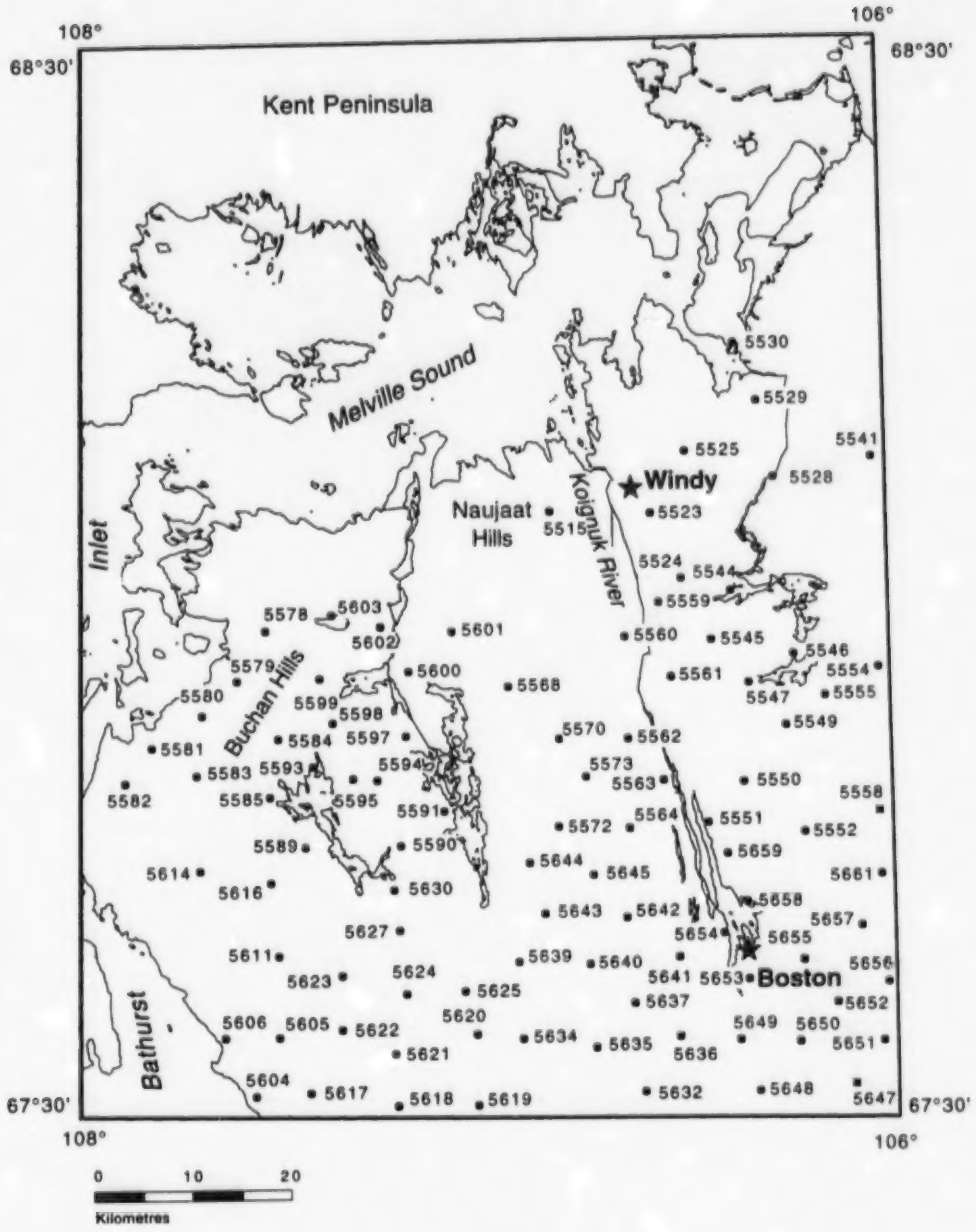

Figure 2. Sample Locations
Rideout Island (76O)

the Buchan and Naujaat Hills.

Regional drainage is northward, into Melville Sound, with a minor westward flow towards Bathurst Inlet. The Koignuk River comprises the largest drainage system, forming a long, north trending basin up to 40 km or more wide that drains into Melville Sound. Its catchment area extends southward beyond the map area. Numerous small lakes occupy glacially scoured bedrock in the west, as well as isolated depressions in marine sediments and wave-washed till in the east. Most drainage ways are shallow; few streams and rivers have cut into bedrock or surficial sediments, with the exception of the Koignuk River which has incised marine and glaciofluvial sediments, and a few smaller unnamed rivers near the coast.

The map area lies north of the treeline, and supports sparse clumps of tundra heath vegetation in rocky areas. In poorly-drained regions underlain by fine-grained marine sediments, low birch, alder, and peat predominate. The Rideout Island/Elu Inlet region lies within the zone of continuous permafrost (Brown, 1967). Climatic data from an Atmospheric Environment Service (AES) weather station operating at Cambridge Bay (120 km to the northeast) indicate an average annual daily air temperature of -15°C (Atmospheric Environment Service, 1982).

REGIONAL GEOLOGY

Bedrock geology

The study area falls within the Bathurst Block of the northeastern Slave Province. Bedrock geology, generalized in Figure 3, consist primarily of Archean volcanic and granitic rocks, Proterozoic sedimentary rocks and gabbro sills and diabase dykes (Fraser, 1964; Roscoe, 1984). Economic interest is focused on the Hope Bay volcanic belt (Gebert, 1990,1993) which is dominated by mafic volcanics with minor felsic volcanics, volcaniclastic rocks, metasedimentary rocks and iron formation. These were metamorphosed from greenschist to amphibolite-facies and intruded by widespread granitic rocks consisting of granite, ganodiorite and gneissic rocks. Proterozoic sedimentary rocks include quartzite, siltstone and minor conglomerate of the Burnside River Formation. Gabbro sills intrude the volcanic, granitic and sedimentary rocks, as do the northwest-trending Mackenzie and Franklin diabase dykes. Many outcrops have been glacially sculptured and striated.

A number of mineral deposits associated with the Hope Bay belt occur in the study area, notably the Boston and Windy gold deposits (Figures 2 and 3), smaller gold showings associated with quartz veins in volcanics, as well as copper prospects in granites. The north end of the belt also hosts an abandoned silver mine where native silver ore was mined in veins. Gossans were observed at sites 5641 and 5650 in the volcanic belt, but no geochemical anomalies were reported in till samples at these locations (see below).

Surficial Geology

Nature of Deposits

Till is a widespread Quaternary sediment in the map area but it is not easily recognized on airphotographs or in the field, i.e., being covered by

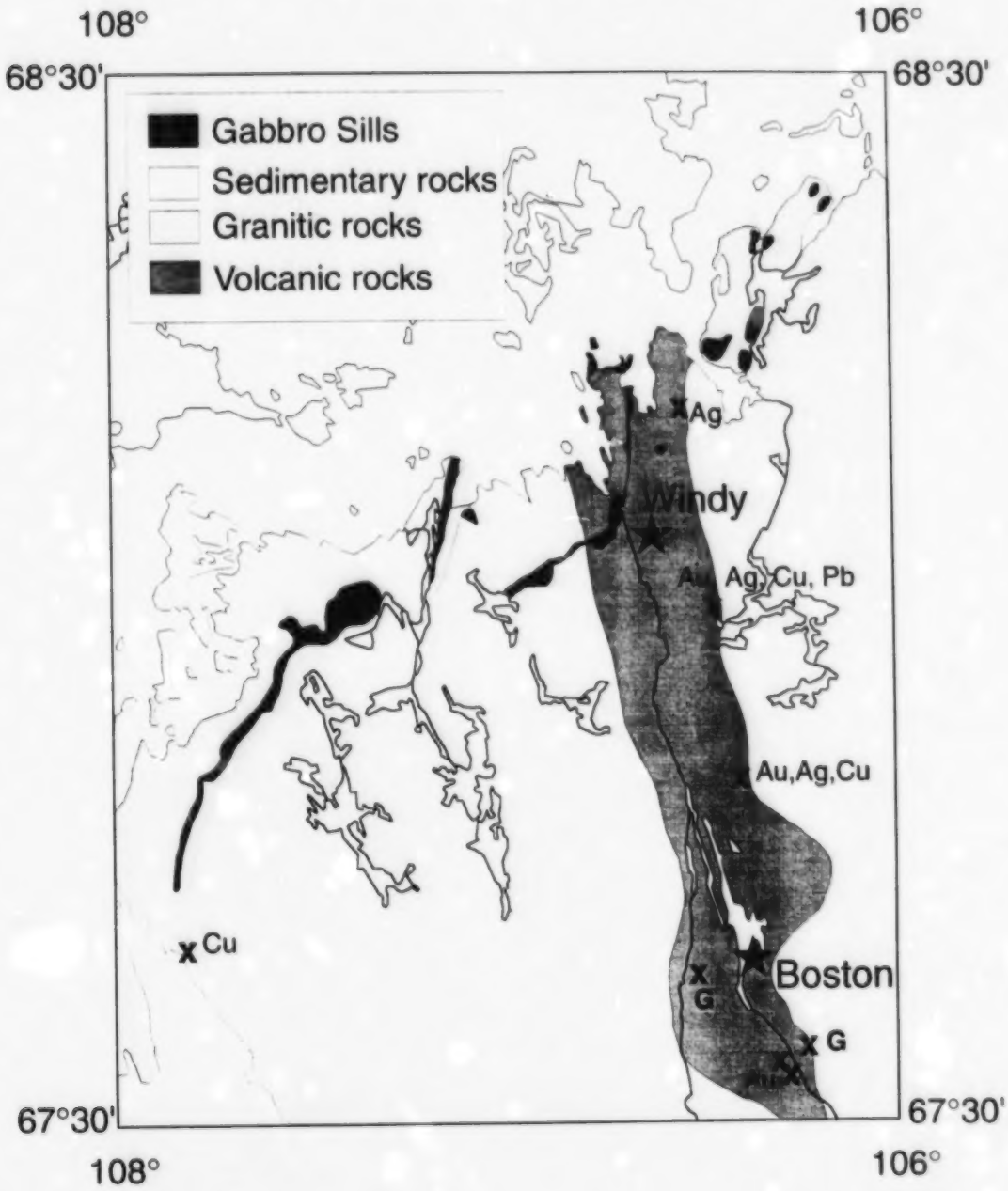

Figure 3. Generalized bedrock geology, selected mineral deposits, gossans (G) and Au, Ag or Cu showings (x), modified from Roscoe (1984) and Gebert (1993).

marine sediments and/or reworked by marine processes because the study area was submerged during and following deglaciation. Till consists of a silty to fine sandy matrix-supported diamicton, and exhibits low to high compaction. It is composed on average of 10 to 30 percent clasts but can reach a maximum of 50 percent clasts, with some being striated. Clasts range in size from small pebbles to large boulders, although medium to large pebbles predominate. Subangular to subrounded clasts are most common.

Till veneers, generally <2 m thick, are common in rocky, more elevated areas containing extensive bedrock outcrops such as the Buchan and Naujaat Hills. Till veneer is generally loosely compact with high concentrations of cobbles and boulders at the surface; where veneer is discontinuous, structural bedrock features are visible on air photographs. In some areas, much of the fine grained sediment in the matrix was removed by meltwater and wave action, resulting in isolated lag deposits consisting of pebble to boulder-sized clasts <2 m in diameter. Till veneers are the main surficial sediment above the limit of marine submergence (approximately 200-220 m a.s.l.). Till blankets are generally >2 m thick, forming low to moderate-relief drumlinoid and crag-and-tail features in the west-central and southeast regions. These tills tend to be relatively compact.

Glaciofluvial deposits consist of eskers, kames and proglacial outwash. Eskers range from small, sinuous ridges a few tens of metres long, to large, more linear features up to 15 km long. They generally trend northwest in the western regions and north northwest to north in the eastern regions. They are rare to absent in the northern half of the map area. Cobble and boulder lags, resulting from wave action during postglacial marine regression, may cover eskers as well as bedrock surfaces between esker segments. Composition ranges from fine sand to cobbles, and may change rapidly over short distances. In the southern half of the map area, small outwash terraces are associated with the esker complexes. As with eskers, their grain size is variable. Esker-outwash complexes generally parallel the dominant glacial flow direction, and those within the Koignuk River valley may be characterised by raised beaches in their flanks. Such glaciofluvial deposits are potential resources for large volumes of granular materials. However, some eskers and outwash sediments are likely cored by massive ice, or are underlain by permafrost which typically results in the formation of ice-wedge polygons. Therefore, geotechnical investigations should be conducted prior to any development.

Marine sediments are the dominant surficial sediment in the map area. They are extensive along the coastal lowlands of Melville Sound, extending up to 75 km inland in the Koignuk River valley, and commonly occupy low areas in the bedrock topography along the coast of Bathurst Inlet. They provide evidence for postglacial marine inundation and subsequent emergence of approximately 220 m. Marine sediments consist primarily of three types: (1) undifferentiated, massive to well stratified clay and silt which may be overlain by a thin sand layer forming a blanket >2 m and up to 20 m or more thick; (2) a veneer ranging in composition from clay to sand and gravel <2 m in thickness covering extensive regions below marine limit; and (3) coarse sand, pebbles and cobbles of littoral origin (raised beaches) found at various elevations from near marine limit to present sea level.

Permafrost has extensively affected marine sediments and evidence for

this is widespread. In many areas along the coast, particularly within the Koignuk River valley, the fine-grained marine blanket deposits are gullied and bare of vegetation cover. Retrogressive thaw flowslides are common along streams in this area, with active slides typically >10 m in diameter and headwalls 1-2 m high. Solifluction lobes are particularly active in fine-grained marine sediments. They show considerable sediment translocation, with lobes ten's of metres long. Locally, significant downslope movement has occurred in recent times as evidenced by solifluction lobes encroaching on raised beaches near present sea level. Ice-wedge polygons are common on most raised beach and sandy littoral sediments. Where littoral sediments form laterally extensive veneers over marine silt or clay, tundra ponds and low centre polygons are common.

Alluvial sediments comprise silt to gravel size sediment deposited by postglacial streams and rivers. They range from massive to well stratified and vary in thickness from 1 to 5 m. Alluvial sediments are associated with meandering and braided stream environments, as well as floodplains and alluvial fans.

Organic sediments consist of peat formed by the accumulation of fibrous, woody and mossy vegetative matter up to 1 m or more in thickness, locally overlain by a dense grass cover. They occur predominantly in topographic depressions and valley bottoms with poor drainage, and are most noticeable below marine limit where they overlie fine-grained marine sediments. Ice-wedge polygons are common in organic sediments, and are rooted in the underlying glaciofluvial or marine deposits. Frozen ground was encountered at depths as shallow as 0.10 m below the surface in peat in late summer.

Glacial history

All glacial features in the study area relate to the Late Wisconsin glaciation. This region became ice-free by about 9000 BP (Dyke and Prest, 1987). The oldest reported striae (1 in Fig. 4) may represent a northwestward ice advance prior to the establishment of the dominant regional patterns, possibly during ice build-up. Alternatively, they may be related to early variations in the dominant, final ice flow (2 in Fig. 4). The youngest and most prominent westward to north-northwestward ice flow indicators (2 in Fig. 4) likely relate to the last phases prior to and during deglaciation, as shown by the distribution of eskers which generally parallel this ice flow. The relative age of westward flows in the northeast and their relation to flows 1 and 2, is unclear at present.

During deglaciation, the study area experienced rapid ice retreat which was simultaneous with the marine incursion across isostatically-depressed terrain. Little evidence exists in this region which can be used to precisely define marine limit elevation, but regional data suggests approximately 220 m, and was formed by 9 000 BP (Kerr, 1994). The size and configuration of postglacial precursors of Bathurst Inlet and Melville Sound evolved as a function of isostatic uplift over the last 9000 years. As sea level dropped to successively lower elevations, numerous beaches were formed where suitable sediments for strandlines were present. It is believed the region is still experiencing uplift at present.

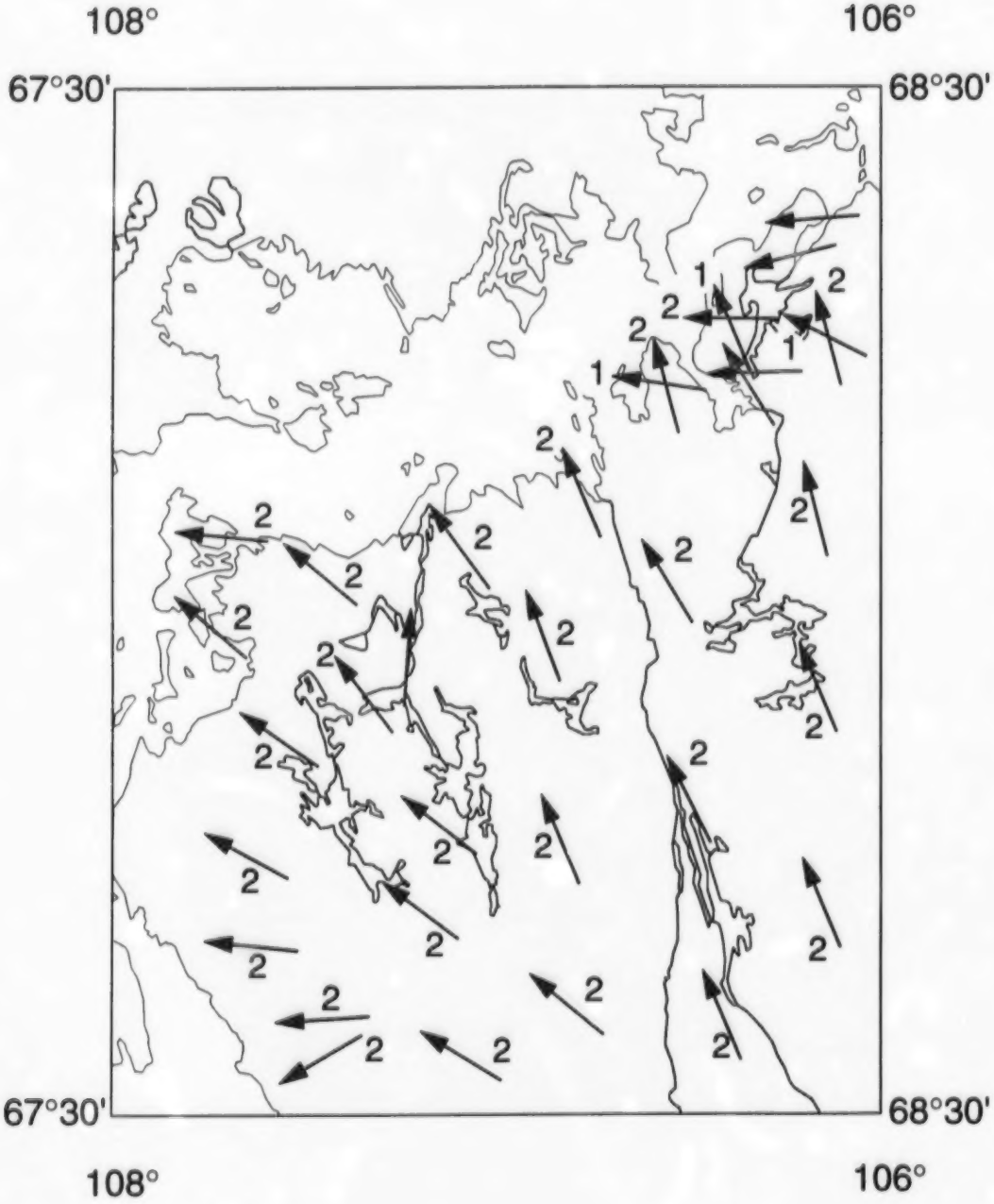

Figure 4. Summary ice flow diagram. 1= oldest flow, 2= youngest flow.

Ice flow directions

Figure 4 is a summary diagram of ice flow direction based on airphoto identification of ice-streamlined landforms and 167 striae measurements, as well as on regional observations made by Blake (1963) in the Rideout Island/Elu Inlet map area. At a few locations in the northeast, cross-cutting striae were noted, and their relationships record an early west-northwestward to north-northwestward flow (1 in Fig. 4), although the extent of this event is not presently known.

Throughout the southern and central study area, a strong pattern of ice flow radiating from the southeast (2 in Fig. 4) is apparent. Flow shifts clockwise from west-southwestward in the southwest region to westward, northwestward and eventually north-northwestward in the northeastern map area (2 in Fig. 4). This flow is responsible for the creation of all streamlined glacial landforms (drumlins and crag-and-tails) in the study area. Where Melville Sound meets Bathurst Inlet, the northwestward flow rotates anticlockwise to a westward flow. Westward flows were also recorded in the coastal zones of the northeastern region. Local variations in ice flow directions were encountered along the eastern edge of the Buchan Hills and are attributed to local topography, deflecting ice northward along major escarpments. Ice appears to have preferentially flowed down the NNW trending axis of the broad shallow Koignuk River valley. A late focus of flow was also directed into Bathurst Inlet. The general radiating pattern for ice is reflected in the orientation of fluted landforms.

Glacial transport distances

To illustrate patterns of glacial dispersal and to estimate transport distances as an aid to mineral exploration, volcanic rocks were chosen as an indicator lithology because of a clearly defined source area, economic importance and clasts that are easily distinguished from sedimentary and granitic rocks. Volcanic pebbles in till occur at about 25% of the 95 sites, and the majority of these sites are underlain by volcanic rocks.

The expected distribution pattern of volcanic pebbles is a sharp decline clast concentration down-ice of the source rock and bedrock contact, as illustrated by Shilts (1975) and other workers. This predicted pattern of clast-content attenuation is clearly evident. The pebble distribution illustrates that the dominant north northwestward flow over the Hope Bay volcanic belt transported clasts northwestward onto granitic terrain to the west. The highest concentrations (up to 90%) of volcanic clasts are found in areas underlain by volcanic bedrock. However, their numbers remain generally low (20-40%) even over the volcanic belt itself. Concentrations decrease rapidly to <20% to 0% approximately 10 km down-ice from the nearest source outcrops. Only 5% of the sites record concentrations up to 8% volcanics 45 km down-ice.

Granitic clasts are the dominant pebble lithology throughout most of the study area, with the majority of sites containing almost 90-100% granite. They mask much of the volcanic belt and dilute the volcanic clast count. Only in the area underlain by sedimentary rocks do the granite clasts show any significant decrease, even though they are present as erratic boulders. The highest concentrations (up to 95-100%) of granitic clasts occur east of the volcanic belt and in the south-central regions. A slight decrease in concentration (to 80%) east of Bathurst Inlet is the result of dilution by sedimentary clasts. These clasts

may be associated to preexisting outcrops which were completely eroded during the last glaciation, or alternatively to unmapped bedrock covered by surficial sediments.

METHODS

Field

In the Rideout Island/Elu Inlet map area 95 till samples of 1-kg size were collected to determine regional geochemical patterns (Figure 2, and Appendix A). Till samples were taken from hand-dug pits in mud-boils at depths ranging from 30 to 70 cm. The pit walls were examined, and sampled only where there was no evidence of incorporated surface organics or iron/manganese staining. Because of periodic overturning of till in the mud boils by frost action, the samples are representative of the overall composition of the till throughout any given pit. The till is slightly weathered, but less oxidized than if B-horizon soils had been sampled.

Laboratory

The till clay size fraction (<0.002 mm) was separated by centrifuge and decantion at the GSC Sedimentology Laboratory prior to analysis by ICP-AES for selected trace, minor and major elements (Table 1) at Chemex Labs, Mississauga, Ontario. The clay-size fraction was chosen because it is commonly used for trace element geochemistry work by the Geological Survey of Canada, and because the clay-sized particles, which have a large surface area per unit volume, have more exposed lattice irregularities than do coarser size fractions. Therefore, they tend to adsorb cations better than larger sized material, thus accentuating the concentrations of metals, and emphasizing the contrast between background and anomalous concentrations of elements (Dilabio, 1995; Shilts, 1995). All the clay-sized samples were digested in an aqua-regia solution (3HCl:1HNO3) prior to analysis; this digestion may be incomplete for Al, Ba, Be, Ca, Cr, Ga, La, Mg, K, Sc, Na, Sr, Tl, Ti, and W. Analytical results are reported in Appendix B. Element concentrations reported as less than the detection limit were converted to values of half the detection level for the calculation of summary statistics and plotting of proportional symbol maps. In all samples, Be, Bi, Cd, Ga, Sb, Tl and W were at or below detection limits.

The silt+clay size fraction (<0.063 mm) of the till was prepared by dry sieving at the GSC and sent to Activation Laboratories Ltd., Ancaster, Ontario for irradiation and analysis using instrumental neutron activation analysis (INAA) on approximately 30 g aliquots. This method is particularly sensitive for rare earth elements (La, Ce, Nd, Sm, Eu, Tb, Yb, and Lu), as well as for Sc, Co, Cr, Cs, Hf, Ta, Th, U, and Au. The <0.063 mm fraction was used for elements that tend to be less detectable in the clay fraction, or for samples that contain insufficient clay material. Geochemical results for 35 elements are presented in Appendix C. For the Rideout Island/Elu Inlet samples, Ag, Hg, Ir, Se, Sn, Sr and W concentrations were at or below detection limits.

Quality control

Accuracy of geochemical analyses was monitored by inserting 8 lab duplicate samples and an "in house" GSC till standard (TCA 8010) into the

Table 1: Analytical methods and detection limits for the <0.002 mm and <0.063 mm fractions

ELEMENT	DETECTION LIMIT	Method	ELEMENT	DETECTION LIMIT	Method
Ag	5 ppm	INAA[1]	Lu	0.05 ppm	INAA
Ag	0.2 ppm	ICP-AES[2]	Mg	0.01 %	ICP-AES
Al	0.01%	ICP-AES	Mn	5 ppm	ICP-AES
As	0.5 ppm	INAA	Mo	1 ppm	INAA
As	2 ppm	ICP-AES	Mo	1 ppm	ICP-AES
Au	2 ppb	INAA	Na	0.01 %	INAA
Ba	50 ppm	INAA	Na	0.01 %	ICP-AES
Ba	10 ppm	ICP-AES	Nd	5 ppm	INAA
Be	0.5 ppm	ICP-AES	Ni	20 ppm	INAA
Bi	2 ppm	ICP-AES	Ni	1 ppm	ICP-AES
Br	0.5 ppm	INAA	Pb	2 ppm	ICP-AES
Ca	1 %	INAA	Rb	5 ppm	INAA
Ca	0.01 %	ICP-AES	Sb	0.1 ppm	INAA
Cd	0.5 ppm	ICP-AES	Sb	2 ppm	ICP-AES
Ce	3 ppm	INAA	Sc	0.1 ppm	INAA
Co	1 ppm	INAA	Sc	1 ppm	ICP-AES
Co	1 ppm	ICP-AES	Se	3 ppm	INAA
Cr	5 ppm	INAA	Sm	0.1 ppm	INAA
Cr	1 ppm	ICP-AES	Sn	0.01 % ppm	INAA
Cs	1 ppm	INAA	Sr	0.05 % ppm	INAA
Cu	1 ppm	ICP-AES	Sr	1 ppm	ICP-AES
Eu	0.2 ppm	INAA	Ta	0.5 ppm	INAA
Fe	0.01 %	INAA	Tb	0.5 ppm	INAA
Fe	0.01 %	ICP-AES	Th	0.2 ppm	INAA
Ga	10 ppm	ICP-AES	Ti	0.01 %	ICP-AES
Hf	1 ppm	INAA	U	0.5 ppm	INAA
Hg	1 ppm	INAA	V	1 ppm	ICP-AES
Hg	1 ppb	ICP-AES	W	1 ppm	INAA
Ir	5 ppm	INAA	Yb	0.2 ppm	INAA
K	0.01 %	ICP-AES	Zn	50 ppm	INAA
La	0.5 ppm	INAA	Zn	2 ppm	ICP-AES
La	10 ppm	ICP-AES			

1. Instrumental neutron activation analysis
2. Inductively coupled plasma-atomic emission spectroscopy

sample batch at regular intervals before sending the samples out for analysis by ICP-AES and INAA. Results for the duplicates from the study, and the measured mean and range of concentrations for the TCA 8010 standard from the last several years are shown in Appendices D and E. The term "dup" refers to a laboratory duplicate split of the original sample. Reproducibility is good for many elements, with concentrations varying only ±10% to ±15%. Duplicate ICP-AES results suggest that Al, Co, Cr, Cu, Fe, Mg, Mn, Ni, V and Zn values have variability of up to 20%. The reproducibility is fair to poor for Ba (±30%), La (±30%), Pb (±30%) and Hg (±70%). Determinations for As are unreliable when obtained using ICP-AES methods because of the As lost due to volatilization during the acid digestion. Results of duplicate analyses show that the data of other elements (Ag, Be, Bi, Cd, Ga, Mo, Sb, U and W) are difficult to assess because concentrations are near the lower detection limit. Element levels for the standard sample in the data set were generally between the minimums and maximums determined for the same standard in other studies, although Co and Hg were above the reported maximum for the standard.

Ce, Co, Cr, Fe, La, Sc and Th data for 8 duplicate samples using INAA methods are generally good, being reproducible from ±10% to ±20%. Concentration levels for Ba, Br, Nd and U are more variable, up to ±25-30%. The reproducibility is poor for As (±75%), Rb (60%) and Zn (90%). Results for INAA duplicates also indicate that Ag, Ca, Cs, Hg, Ir, Mo, Ni, Sb, Se, Sn, Sr, Ta, Tb, and W data have very low reproducibility (±100%), as they are at or near detection limit in most cases. Repeated analyses of the standard samples in the Rideout Island/Elu Inlet data set showed concentration levels falling within the minimum to maximum range of values obtained in other studies.

RESULTS

Trace Element Geochemistry

Plots of regional concentrations for trace elements listed in Table 1 and Appendices B and C are shown by histograms and proportional dot maps in Appendices F and G. These figures also show values for the 25th, 50th, 75th, 90th, 95th, 97th, 99th and 100th percentiles of the population, so that both the general distribution of elements, and the location of anomalies can be seen. Descriptive statistics, useful for comparing elements and results from the two analytical methods, are provided in Tables 2 and 3.

Correlation coefficients (r) of > 0.23 or <-0.23 in Tables 4 and 5 indicate statistically significant correlations at the 99% confidence level (96 observations were used in computations). Table 4 indicates that combinations of Al-Cr-Fe, Ba-Cr-Mg-Zn, and Cr-Mg-Ni-Zn have correlations near or above 0.7 for the <0.002 mm fraction, and the <0.063 mm fraction (Table 5) shows relatively high correlations above 0.7 between Ce-Co-Cr-Fe-La-Nd-Sc. It is suggested that statistical correlations be examined in conjunction with elemental plots illustrating the geographic areas where these combinations of elements are present in high concentrations, as they may be of interest to mineral exploration. Several Au, Ag, Cu, Zn, Pb and Cu showings have been reported in the study area (Figure 3).

Table 2: Descriptive Statistics for ICP-AES data (<0.002 mm fraction) Rideout Island

	Mean	Std. Dev.	Count	Minimum	Maximum	Coef. Var.	Geom. Mean	Skewness	Kurtosis	Median	Mode
Ag ppm	0.10	0.02	97	0.10	0.20	0.17	0.10	5.42	27.37	0.10	0.10
Al %	3.48	0.80	97	0.01	5.29	0.23	3.25	-0.69	2.53	3.57	•
As ppm	8.05	9.70	97	1.00	72.00	1.20	4.97	3.64	18.66	6.00	2.00
Ba ppm	116.08	55.93	97	10.00	270.00	0.48	102.27	0.66	-0.24	100.00	90.00
Be ppm	0.62	0.27	97	0.25	1.50	0.43	0.57	1.86	2.85	0.50	0.50
Bi ppm	1.01	0.10	97	1.00	2.00	0.10	1.01	9.70	92.01	1.00	1.00
Ca %	0.52	0.28	97	0.01	1.85	0.53	0.44	1.57	5.39	0.49	•
Cd ppm	0.28	0.14	97	0.05	1.50	0.51	0.26	7.04	57.07	0.25	0.25
Co ppm	25.15	10.56	97	1.00	54.00	0.42	22.76	0.97	0.97	23.00	21.00
Cr ppm	72.62	23.97	97	1.00	156.00	0.33	66.84	0.34	1.02	72.00	66.00
Cu ppm	112.01	70.00	97	1.00	416.00	0.62	92.41	1.73	3.89	94.00	62.00
Fe %	4.38	1.03	97	0.01	6.84	0.23	4.07	-0.60	2.28	4.40	•
Ga ppm	8.20	2.41	97	5.00	10.00	0.29	7.79	-0.58	-1.66	10.00	10.00
Hg ppb	60.68	52.48	97	1.00	290.00	0.86	39.33	1.48	2.91	50.00	10.00
K %	0.46	0.25	97	0.01	1.14	0.56	0.38	0.75	-0.35	0.38	•
La ppm	48.76	18.22	97	10.00	150.00	0.37	45.91	2.09	8.71	40.00	40.00
Mg %	1.35	0.53	97	0.01	2.44	0.39	1.20	-0.05	-0.69	1.38	•
Mn ppm	454.95	238.95	97	5.00	1940.00	0.53	399.99	2.92	14.45	425.00	•
Mo ppm	1.12	1.03	97	0.50	7.00	0.92	0.88	2.88	10.50	1.00	0.50
Na %	0.94	0.42	97	0.01	2.64	0.44	0.84	1.00	1.77	0.85	0.85
Ni ppm	45.15	16.26	97	1.00	95.00	0.36	41.23	0.42	0.76	44.00	•
P ppm	4840.82	2429.78	73	1500.00	9810.00	0.50	4164.42	0.19	-1.08	4910.00	•
Pb ppm	12.95	5.84	97	2.00	40.00	0.45	11.91	2.01	5.55	12.00	10.00
Sb ppm	1.03	0.17	97	1.00	2.00	0.17	1.02	5.42	27.37	1.00	1.00
Sc ppm	6.78	2.38	97	1.00	15.00	0.35	6.28	0.30	0.97	7.00	6.00
Sr ppm	38.73	19.98	97	1.00	140.00	0.52	34.06	1.93	6.18	34.00	29.00
Ti %	0.12	0.05	97	0.01	0.23	0.39	0.11	0.27	-0.46	0.12	•
Tl ppm	5.05	0.51	97	5.00	10.00	0.10	5.04	9.70	92.01	5.00	5.00
U ppm	8.56	11.46	97	5.00	80.00	1.34	6.35	4.30	19.79	5.00	5.00
V ppm	80.38	23.67	97	1.00	198.00	0.29	74.98	1.00	6.13	80.00	96.00
W ppm	5.05	0.51	97	5.00	10.00	0.10	5.04	9.70	92.01	5.00	5.00
Zn ppm	89.15	31.05	97	2.00	180.00	0.35	81.55	0.01	-0.18	84.00	78.00

Table 3: Descriptive Statistics for INAA data (<0.063 mm fraction), Rideout Island

	Mean	Std. Dev.	Count	Minimum	Maximum	Coef. Var.	Geom. Mean	Skewness	Kurtosis	Median	Mode
Au ppb	3.31	4.97	97	1.00	42.00	1.50	2.08	5.42	37.06	2.00	1.00
Ag ppm	2.55	0.36	97	2.50	5.00	0.14	2.54	6.75	43.52	2.50	2.50
As ppm	3.07	2.22	97	0.25	12.00	0.73	2.38	1.72	3.23	2.50	1.80
Ba ppm	585.05	113.88	97	50.00	910.00	0.19	566.95	-1.06	4.72	590.00	610.00
Br ppm	9.68	9.16	97	0.50	52.00	0.95	6.91	2.46	6.90	7.10	11.00
Ca %	1.91	0.71	97	0.50	4.00	0.37	1.74	-0.19	0.38	2.00	2.00
Co ppm	11.18	4.75	97	1.00	29.00	0.43	10.20	1.10	1.39	10.00	8.00
Cr ppm	59.60	21.57	97	5.00	160.00	0.36	55.92	1.84	5.95	53.00	62.00
Cs ppm	1.22	0.90	97	0.50	4.00	0.74	0.95	1.13	0.47	1.00	0.50
Fe %	2.76	0.80	97	0.01	5.92	0.29	2.55	0.85	3.40	2.59	•
Hf ppm	9.28	2.27	97	1.00	15.00	0.24	8.90	-0.50	1.16	9.00	•
Hg ppm	0.52	0.09	97	0.50	1.00	0.17	0.51	5.42	27.37	0.50	0.50
Ir ppm	2.53	0.25	97	2.50	5.00	0.10	2.52	9.70	92.01	2.50	2.50
Mo ppm	1.25	1.64	97	0.50	10.00	1.31	0.79	2.91	9.69	0.50	0.50
Na %	2.04	0.30	97	0.01	2.44	0.15	1.93	-3.74	20.25	2.07	2.00
Ni ppm	23.32	31.17	97	10.00	150.00	1.34	14.54	2.35	4.71	10.00	10.00
Rb ppm	68.42	24.88	97	15.00	150.00	0.36	64.19	0.92	0.77	61.00	•
Sb ppm	0.10	0.10	97	0.05	0.50	0.97	0.08	2.02	3.53	0.05	0.05
Sc ppm	10.00	2.28	97	0.10	17.00	0.23	9.44	-0.14	4.42	9.70	10.00
Se ppm	1.66	0.59	97	1.50	5.00	0.35	1.61	3.79	14.35	1.50	1.50
Sn %	0.01	0.00	97	0.01	0.01	0.10	0.01	9.70	92.01	0.01	0.01
Sr %	0.03	0.01	97	0.03	0.08	0.41	0.03	2.49	5.14	0.03	0.03
Ta ppm	0.54	0.40	97	0.25	1.60	0.75	0.42	0.97	-0.52	0.25	0.25
Th ppm	10.72	3.58	97	0.20	20.00	0.33	9.93	0.63	0.80	10.00	11.00
U ppm	3.18	4.88	97	0.25	43.00	1.53	2.17	6.20	45.14	2.10	1.80
W ppm	0.51	0.05	97	0.50	1.00	0.10	0.50	9.70	92.01	0.50	0.50
Zn ppm	75.49	40.82	97	25.00	256.00	0.54	64.45	1.12	2.96	74.00	25.00
La ppm	35.08	12.81	97	0.50	100.00	0.37	32.37	1.95	7.29	33.00	31.00
Ce ppm	68.82	22.99	97	3.00	190.00	0.33	64.66	1.87	8.00	65.00	•
Nd ppm	27.76	8.84	97	5.00	66.00	0.32	26.43	1.34	3.85	26.00	23.00
Sm ppm	5.00	1.52	97	0.10	11.00	0.30	4.70	1.36	5.23	4.70	•
Eu ppm	1.21	0.23	97	0.20	2.00	0.19	1.18	-0.03	5.13	1.20	1.30
Tb ppm	0.34	0.18	97	0.25	1.00	0.52	0.31	1.74	1.94	0.25	0.25
Yb ppm	1.88	0.33	97	0.20	2.70	0.17	1.83	-1.52	7.02	1.90	2.00
Lu ppm	0.28	0.05	97	0.05	0.38	0.17	0.27	-1.29	5.31	0.28	0.28

Table 4: Correlation matrix for ICP-AES data (<0.002 mm fraction), Rideout Island

	Al %	Ba ppm	Ca %	Co ppm	Cr ppm	Cu ppm	Fe %	La ppm	Mg %	Mn ppm	Ni ppm	Pb ppm	V ppm	Zn ppm
Al %	1.00	0.39	-0.12	0.27	0.73	0.13	0.75	-0.15	0.56	0.20	0.53	0.27	0.58	0.57
Ba ppm	0.39	1.00	0.64	0.08	0.65	-0.08	0.35	0.07	0.79	0.22	0.52	0.07	0.30	0.69
Ca %	-0.12	0.64	1.00	0.13	0.21	-0.02	0.01	0.20	0.45	0.35	0.25	-0.04	0.00	0.37
Co ppm	0.27	0.08	0.13	1.00	0.36	0.53	0.53	0.34	0.24	0.80	0.63	0.56	0.34	0.36
Cr ppm	0.73	0.65	0.21	0.36	1.00	0.14	0.72	0.04	0.77	0.34	0.79	0.22	0.57	0.75
Cu ppm	0.13	-0.08	-0.02	0.53	0.14	1.00	0.46	0.54	-0.02	0.51	0.39	0.42	0.47	0.11
Fe %	0.75	0.35	0.01	0.53	0.72	0.46	1.00	0.11	0.55	0.54	0.61	0.49	0.86	0.60
La ppm	-0.15	0.07	0.20	0.34	0.04	0.54	0.11	1.00	-0.19	0.45	0.12	0.25	0.01	-0.10
Mg %	0.56	0.79	0.45	0.24	0.77	-0.02	0.55	-0.19	1.00	0.26	0.68	0.17	0.52	0.89
Mn ppm	0.20	0.22	0.35	0.80	0.34	0.51	0.54	0.45	0.26	1.00	0.44	0.50	0.35	0.29
Ni ppm	0.53	0.52	0.25	0.63	0.79	0.39	0.61	0.12	0.68	0.44	1.00	0.26	0.47	0.74
Pb ppm	0.27	0.07	-0.04	0.56	0.22	0.42	0.49	0.25	0.17	0.50	0.26	1.00	0.46	0.38
V ppm	0.58	0.30	0.00	0.34	0.57	0.47	0.86	0.01	0.52	0.35	0.47	0.46	1.00	0.51
Zn ppm	0.57	0.69	0.37	0.36	0.75	0.11	0.60	-0.10	0.89	0.29	0.74	0.38	0.51	1.00

96 observations were used in this computation.

Table 5: Correlation matrix for INAA data (<0.063 mm fraction) Rideout Island

	Au ppb	Ba ppm	Ce ppm	Co ppm	Cr ppm	Fe %	La ppm	Nd ppm	Rb ppm	Sc ppm
Au ppb	1.00	-0.05	0.18	0.24	0.11	0.18	0.16	0.18	-0.01	0.20
Ba ppm	-0.05	1.00	0.35	0.22	0.44	0.35	0.38	0.37	0.36	0.40
Ce ppm	0.18	0.35	1.00	0.75	0.64	0.80	0.98	0.95	0.59	0.76
Co ppm	0.24	0.22	0.75	1.00	0.79	0.93	0.69	0.68	0.39	0.89
Cr ppm	0.11	0.44	0.64	0.79	1.00	0.83	0.62	0.60	0.36	0.84
Fe %	0.18	0.35	0.80	0.93	0.83	1.00	0.77	0.75	0.45	0.94
La ppm	0.16	0.38	0.98	0.69	0.62	0.77	1.00	0.96	0.58	0.72
Nd ppm	0.18	0.37	0.95	0.68	0.60	0.75	0.96	1.00	0.60	0.71
Rb ppm	-0.01	0.36	0.59	0.39	0.36	0.45	0.58	0.60	1.00	0.34
Sc ppm	0.20	0.40	0.76	0.89	0.84	0.94	0.72	0.71	0.34	1.00

96 observations were used in this computation.

ICP-AES data on the <0.002 mm fraction

The maps in Appendix F show the distribution of fourteen elements analysed by ICP-AES methods for the <0.002 mm fraction. Although element concentrations appear to be related to rock types to a limited extent, in most cases, well-defined regional relationships are not apparent. Generally, there does appear to be some relationship between the distribution of highest values of specific elements with either volcanic rocks or granitic bedrock. Only a few selected elements have high concentrations over both rock types. Element distributions described below suggest that further investigation for mineral exploration may be warranted.

High concentrations of Co, Cr, Cu, Fe, Mg, Mn and Ni are generally associated with volcanic rocks, either at the north end or south end of the belt. Locally, elevated Cu and Fe values occur down-ice of gabbro sills in the Buchan Hills area, and some high values for Mn are found immediately down-ice (west) of volcanic rocks. Elevated Ba values relate more closely to granitic bedrock in the western regions. Elements with high concentrations associated to both volcanic and granitic bedrock include Al, La, Pb, V and Zn.

Of particular interest are the highest concentrations of Pb-Zn at site 5606 underlain by granite, Cr-Mg-Ni at site 5523 underlain by volcanic rocks, and Cu-V at site 5581 underlain by granite but down-ice from a gabbroic sill.

No combination of kimberlite associated elements such as Ba, Ca, Cr, Fe, La, Mg, Ni, Sr, Ta, Th, Ce, Nd (Mitchell, 1986) is evident in the study area, and no kimberlites have been reported within the region.

Concentrations of Cd and Hg, naturally occurring metals known to be toxic, are either below analytical detection limits in this area or have low reproducibility. The distribution of other elements of environmental concern, such as Cr, Cu, Ni, Pb, and Zn, is variable, as shown in Appendices F and G. Concentration ranges, means, and maximum values are summarized in Table 2.

INAA data on the <0.063 mm fraction

In general, concentrations of elements in the <0.063 mm fraction (analyzed by INAA) are lower than in the clay-sized fraction (analyzed by ICP-AES), although Ba is a notable exception, and Cr values are similar. The contrast between background and anomalous concentrations is also less than in the clay sized fraction; these differences may exist because metal cations were scavenged less efficiently in the silt fraction than in the clay fraction, which has more surface area and more lattice irregularities per unit volume (Cotton and Wilkinson, 1966), or because Ba and Cr are abundant in minerals present in the silt size material. The ten elemental dot maps in Appendix G show that the overall geographic distribution of high and low concentrations also varies considerably in the two size ranges.

As with some of the ICP-AES data, distinct element patterns are difficult to discern regionally. Element concentrations at sample sites may be related to underlying bedrock to a limited extent, but in most cases, well-defined relationships are not apparent. However, high Au values are predominant over the volcanic belt, whereas elevated Rb values are associated with granitic rocks in the western half of the study area. In areas underlain by volcanic rock, the highest values for Au (42 ppb) was at site 5649, Ce (190 ppm) and Co (29 ppm)

at site 5654, Cr (160 ppm) at site 5523, La, Nd and Sc at site 5654. Areas of granitic terrain are characterised by the highest values for Ba (site 5617), Fe (site 5617) and Rb (site 5583). High or low concentrations of Ba, Ce, Co, Cr, Fe, La, Nd and Sc do not appear to clearly relate to specific bedrock types. Possible explanations for no well-defined trends include, recurring or concealed rock type, ice flow history, wide sample spacing, and glacial transport distances.

There are a limited number of sites with high concentrations of multiple elements apparent in the INAA data. For instance, site 5654, underlain by volcanic rocks, contains elevated values of Ce-Co-La-Nd-Sc, and site 5617, underlain by granitic rocks, exhibits an anomalous combination of Ba-Fe.

The proportional dot maps in Appendix G indicate that the overall geographic distribution of high and low concentrations of elements in the INAA data are somewhat different than from the ICP-AES data for Fe and La. Ba, Co, and Cr generally have comparable values at most sites with the exception of 5564.

With respect to elements relevant to environmental issues, all samples contain Hg concentrations below detection level, and the reproducibility of As is poor.

SUMMARY

The Rideout Island/Elu Inlet map area is underlain by Archean metavolcanic and metasedimentary rocks of the north trending Hope Bay volcanic belt, granitoid rocks, Proterozoic sedimentary rocks in the northwest, and gabbro sills forming prominent escarpments. During the last glaciation, ice flow shifted clockwise from west-southwestward in the southwest region to westward, northwestward and eventually north-northwestward in the northeastern map area. Pebble sized volcanic clasts were transported generally less than 10 km from their bedrock sources, though transport distances may be as high as 45 km or more. Trace element geochemical analyses of 95 till samples show that there is a relationship between elevated concentrations of Au, Ce, Co, Cr, La, Mg, Nd and Ni and economically significant volcanic rocks of the Hope Bay volcanic belt, where the highest values for Cu-Pb-Zn related to granitic sources. However, no one specific well-defined target based on till geochemistry is evident due to recurring rock type, ice flow history, glacial transport distances and widely spaced samples. Known gold deposits hosted in the Archean volcanic rocks are not readily reflected in the regional till geochemistry data, likely because gold dispersal trains are known to be short, and that no till samples were collected in the immediate vicinity of gold occurrences.

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Appendix A: Sample Locations

Sample	Zone	Easting	Northing	Sample	Zone	Easting	Northing
97 KKA 5500	13W	382828	7555258	97 KKA 5546	13W	448033	7535216
97 KKA 5501	13W	383133	7551350	97 KKA 5547	13W	443267	7532368
97 KKA 5502	13W	380200	7546500	97 KKA 5548	13W	437791	7527959
97 KKA 5503	13W	387200	7549000	97 KKA 5549	13W	446911	7527856
97 KKA 5504	13W	392875	7550600	97 KKA 5550	13W	442314	7522093
97 KKA 5505	13W	391389	7545904	97 KKA 5551	13W	438426	7517991
97 KKA 5506	13W	396838	7547653	97 KKA 5552	13W	448416	7516625
97 KKA 5507	13W	401444	7545628	97 KKA 5553	13W	453304	7540380
97 KKA 5508	13W	405817	7549430	97 KKA 5554	13W	456810	7533533
97 KKA 5509	13W	411848	7557822	97 KKA 5555	13W	451109	7530789
97 KKA 5510	13W	413079	7553078	97 KKA 5556	13W	456710	7526466
97 KKA 5511	13W	410811	7545322	97 KKA 5557	13W	452120	7523715
97 KKA 5512	13W	416038	7549017	97 KKA 5558	13W	456292	7518570
97 KKA 5513	13W	419684	7556599	97 KKA 5559	13W	434357	7541066
97 KKA 5514	13W	420250	7545533	97 KKA 5560	13W	430703	7537630
97 KKA 5515	13W	423467	7550909	97 KKA 5561	13W	435266	7533294
97 KKA 5516	13W	427390	7545837	97 KKA 5562	13W	430507	7527014
97 KKA 5517	13W	428453	7553581	97 KKA 5563	13W	434016	7522556
97 KKA 5518	13W	428430	7562500	97 KKA 5564	13W	430300	7517729
97 KKA 5519	13W	427667	7567279	97 KKA 5565	13W	426775	7541867
97 KKA 5520	13W	435853	7570294	97 KKA 5566	13W	419460	7541435
97 KKA 5521	13W	435578	7563652	97 KKA 5567	13W	422527	7537133
97 KKA 5522	13W	432469	7559991	97 KKA 5568	13W	418252	7532905
97 KKA 5523	13W	433894	7550324	97 KKA 5569	13W	426130	7532215
97 KKA 5524	13W	436777	7543492	97 KKA 5570	13W	423338	7527307
97 KKA 5525	13W	437717	7556567	97 KKA 5571	13W	419023	7523378
97 KKA 5526	13W	442237	7549492	97 KKA 5572	13W	422904	7518149
97 KKA 5527	13W	447403	7544039	97 KKA 5573	13W	425979	7523246
97 KKA 5528	13W	446721	7553600	97 KKA 5574	13W	384222	7543536
97 KKA 5529	13W	445300	7561600	97 KKA 5575	13W	379815	7539780
97 KKA 5530	13W	443161	7567600	97 KKA 5576	13W	375927	7534731
97 KKA 5531	13W	443070	7576147	97 KKA 5577	13W	386819	7538588
97 KKA 5532	13W	447270	7581253	97 KKA 5578	13W	393477	7539742
97 KKA 5533	13W	451420	7587245	97 KKA 5579	13W	390306	7534666
97 KKA 5534	13W	457558	7585458	97 KKA 5580	13W	386514	7531244
97 KKA 5535	13W	454444	7579368	97 KKA 5581	13W	381222	7528143
97 KKA 5536	13W	448296	7572864	97 KKA 5582	13W	378304	7524568
97 KKA 5537	13W	455787	7573250	97 KKA 5583	13W	385675	7525035
97 KKA 5538	13W	451240	7566605	97 KKA 5584	13W	394250	7528477
97 KKA 5539	13W	457275	7565187	97 KKA 5585	13W	393078	7522514
97 KKA 5540	13W	453306	7558762	97 KKA 5586	13W	387767	7518468
97 KKA 5541	13W	456953	7555400	97 KKA 5587	13W	381789	7519721
97 KKA 5542	13W	452350	7549750	97 KKA 5588	13W	374545	7519084
97 KKA 5543	13W	456624	7544355	97 KKA 5589	13W	396554	7517131
97 KKA 5544	13W	441824	7542028	97 KKA 5589	13W	396554	7517131
97 KKA 5545	13W	439630	7536974	97 KKA 5590	13W	406401	7516876
97 KKA 5546	13W	448033	7535216	97 KKA 5591	13W	411000	7520300

Appendix A: Sample Locations

Sample	Zone	Easting	Northing	Sample	Zone	Easting	Northing
97 KKA 5592	13W	401054	7520886	97 KKA 5638	13W	421822	7500703
97 KKA 5593	13W	397744	7525445	97 KKA 5639	13W	418135	7504275
97 KKA 5594	13W	404224	7523760	97 KKA 5640	13W	425524	7503736
97 KKA 5595	13W	401767	7524035	97 KKA 5641	13W	434887	7504112
97 KKA 5596	13W	414216	7530380	97 KKA 5642	13W	429614	7508484
97 KKA 5597	13W	407409	7528243	97 KKA 5643	13W	421082	7509197
97 KKA 5598	13W	399956	7529908	97 KKA 5644	13W	419671	7514534
97 KKA 5599	13W	398797	7534597	97 KKA 5645	13W	426294	7513004
97 KKA 5600	13W	407987	7534899	97 KKA 5646	13W	434523	7511964
97 KKA 5600	13W	407987	7534899	97 KKA 5647	13W	452666	7490194
97 KKA 5601	13W	412635	7538873	97 KKA 5648	13W	442686	7489877
97 KKA 5602	13W	405344	7539659	97 KKA 5649	13W	440842	7495266
97 KKA 5603	13W	400310	7541126	97 KKA 5650	13W	447060	7494847
97 KKA 5604	13W	390270	7491550	97 KKA 5651	13W	455818	7494572
97 KKA 5605	13W	392968	7497491	97 KKA 5652	13W	451087	7498780
97 KKA 5606	13W	387382	7497703	97 KKA 5653	13W	442025	7501543
97 KKA 5607	13W	380834	7512333	97 KKA 5654	13W	439613	7506419
97 KKA 5608	13W	377239	4516444	97 KKA 5655	13W	447745	7503354
97 KKA 5609	13W	384210	7501855	97 KKA 5656	13W	456512	7500725
97 KKA 5610	13W	390654	7502656	97 KKA 5657	13W	453916	7506697
97 KKA 5611	13W	393229	7505954	97 KKA 5658	13W	442136	7509620
97 KKA 5612	13W	386570	7506962	97 KKA 5659	13W	440315	7514698
97 KKA 5613	13W	381854	7508429	97 KKA 5660	13W	448859	7511225
97 KKA 5614	13W	385566	7515156	97 KKA 5661	13W	456239	7511942
97 KKA 5615	13W	388568	7510678	97 KKA 5662	13W	451651	7557864
97 KKA 5616	13W	392797	7513610	97 KKA 5663	13W	454481	7571924
97 KKA 5617	13W	395923	7491645	97 KKA 5664	13W	451472	7575454
97 KKA 5618	13W	404896	7489876	97 KKA 5665	13W	454828	7576660
97 KKA 5619	13W	413238	7489640	97 KKA 5666	13W	437192	7568323
97 KKA 5620	13W	413397	7496989	97 KKA 5667	13W	387939	7494050
97 KKA 5621	13W	404846	7495319	97 KKA 5668	13W	391920	7490955
97 KKA 5622	13W	399457	7498068	97 KKA 5669	13W	404669	7531970
97 KKA 5623	13W	399696	7503627				
97 KKA 5624	13W	406273	7501451				
97 KKA 5625	13W	412350	7501497				
97 KKA 5626	13W	412640	7506873				
97 KKA 5627	13W	405855	7508061				
97 KKA 5628	13W	398541	7509132				
97 KKA 5629	13W	399248	7513346				
97 KKA 5630	13W	405490	7512299				
97 KKA 5631	13W	412767	7513296				
97 KKA 5632	13W	430747	7490250				
97 KKA 5633	13W	422368	7490716				
97 KKA 5634	13W	418210	7496316				
97 KKA 5635	13W	425867	7495090				
97 KKA 5636	13W	434662	7495871				
97 KKA 5637	13W	430039	7499506				

Appendix B: ICP-AES data (<0.002 mm)

Sample	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppb	K %	La ppm
Detection limit	0.2	0.01	2	10	0.5	2	0.01	0.5	1	1	1	0.01	10	1	0.01	10
97 KKA 5515	<0.2	4.34	18	80	0.5	<2	0.51	<0.5	53	132	204	6.1	10	50	0.22	50
97 KKA 5523	<0.2	4.79	14	200	1	<2	0.63	<0.5	28	156	180	6.2	10	10	0.89	50
97 KKA 5524	<0.2	3.91	2	190	0.5	<2	0.6	<0.5	26	118	104	5.3	10	10	0.95	50
97 KKA 5525	<0.2	3.74	4	130	0.5	<2	0.59	<0.5	25	57	142	4.9	10	20	0.66	40
97 KKA 5528	<0.2	3.46	<2	90	0.5	<2	0.66	<0.5	24	49	158	4.2	10	40	0.32	60
97 KKA 5529	<0.2	3.28	<2	60	0.5	<2	0.43	<0.5	17	43	116	4.3	10	70	0.23	50
97 KKA 5530	<0.2	3.57	2	160	0.5	<2	0.68	<0.5	21	85	45	4.9	10	10	0.83	40
97 KKA 5541	<0.2	3.87	<2	90	0.5	<2	0.65	<0.5	33	75	167	5.1	10	40	0.39	50
97 KKA 5544	<0.2	2.87	<2	90	0.5	<2	0.55	<0.5	23	43	63	3.3	<10	40	0.37	30
97 KKA 5545	<0.2	4.47	4	160	0.5	<2	0.53	<0.5	23	100	253	4.7	10	50	0.61	80
97 KKA 5546A	<0.2	2.69	4	90	0.5	<2	0.45	<0.5	20	51	126	3.7	<10	50	0.3	60
97 KKA 5546B	<0.2	2.8	2	80	0.5	<2	0.43	<0.5	21	50	140	3.6	<10	50	0.3	70
97 KKA 5547	<0.2	3.87	<2	110	0.5	<2	0.49	<0.5	24	58	82	4.4	10	70	0.41	40
97 KKA 5549	<0.2	2.68	2	100	0.5	<2	0.57	<0.5	26	57	127	3.5	<10	20	0.38	50
97 KKA 5550	<0.2	4.15	2	120	0.5	<2	0.42	<0.5	28	108	243	6.3	10	60	0.49	60
97 KKA 5551	<0.2	3.78	14	130	0.5	<2	0.56	<0.5	39	90	266	5.1	10	40	0.37	50
97 KKA 5552	<0.2	3.28	4	170	0.5	<2	0.49	<0.5	18	89	36	4.3	10	10	0.82	40
97 KKA 5554	<0.2	3.89	6	100	1	<2	0.36	<0.5	25	84	141	4.1	10	80	0.37	80
97 KKA 5555	<0.2	2.5	<2	80	<0.5	<2	0.81	<0.5	20	52	75	3.6	<10	<10	0.42	50
97 KKA 5558	<0.2	2.54	2	80	0.5	<2	0.57	<0.5	21	44	68	2.9	<10	20	0.29	50
97 KKA 5559	<0.2	4.32	4	200	0.5	<2	0.6	<0.5	28	116	134	5.5	10	10	0.75	50
97 KKA 5560	<0.2	4.69	18	120	0.5	<2	0.53	<0.5	38	95	110	5.4	10	50	0.36	30
97 KKA 5561	<0.2	4.62	<2	200	0.5	<2	0.76	<0.5	24	116	58	5.6	10	10	0.87	40
97 KKA 5562	<0.2	4.66	18	70	0.5	<2	0.32	0.5	40	97	182	6.8	10	110	0.15	30
97 KKA 5563	0.2	5.29	30	50	1	<2	0.15	<0.5	29	75	104	5.6	<10	290	0.15	50
97 KKA 5564	0.2	3.65	36	60	0.5	<2	0.45	<0.5	54	81	190	5.7	10	70	0.26	40
97 KKA 5568	<0.2	3.98	6	180	0.5	<2	0.87	<0.5	22	89	86	4.7	10	20	0.86	40
97 KKA 5570	<0.2	2.51	4	80	0.5	<2	0.79	<0.5	21	69	79	4.2	<10	10	0.46	60
97 KKA 5572	<0.2	3.5	8	140	0.5	<2	0.63	<0.5	24	86	222	5.4	10	30	0.71	70
97 KKA 5573	<0.2	4.06	32	70	1	<2	0.3	0.5	49	66	166	5.9	<10	90	0.16	70
97 KKA 5578	<0.2	3.49	8	60	0.5	<2	0.14	<0.5	11	51	80	4.1	10	170	0.22	30
97 KKA 5579	<0.2	3.06	6	40	1	<2	0.1	<0.5	8	49	149	3.8	<10	210	0.16	80

Appendix B: ICP-AES data (<0.002 mm)

Sample	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	Pb ppm	Sb ppm	Sc ppm	Sr ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Zn ppm
Detection limit	0.01	5	1	0.01	1	2	2	1	1	0.01	10	10	1	10	2
97 KKA 5515	2.06	1095	<1	0.85	83	18	<2	11	34	0.16	<10	<10	102	<10	116
97 KKA 5523	2.44	465	3	0.59	95	12	<2	13	39	0.23	<10	<10	123	<10	138
97 KKA 5524	2.24	510	1	0.5	62	10	<2	10	40	0.21	<10	<10	96	<10	126
97 KKA 5525	1.91	535	1	0.85	42	12	<2	8	33	0.17	<10	<10	90	<10	118
97 KKA 5528	1.49	490	3	0.58	36	10	<2	7	33	0.16	<10	<10	74	<10	86
97 KKA 5529	1.35	400	1	0.67	24	10	<2	6	26	0.12	<10	10	81	<10	78
97 KKA 5530	2.14	790	<1	0.48	40	8	<2	9	36	0.22	<10	<10	98	<10	106
97 KKA 5541	1.86	620	1	1.06	51	16	<2	8	29	0.14	<10	40	102	<10	104
97 KKA 5544	1.41	445	<1	0.81	36	10	<2	6	26	0.09	<10	<10	55	<10	74
97 KKA 5545	1.69	335	1	1.29	70	14	<2	9	47	0.13	<10	<10	87	<10	108
97 KKA 5546A	0.94	335	1	1.9	36	10	<2	5	25	0.08	<10	<10	68	<10	70
97 KKA 5546B	0.96	365	1	1.51	38	10	<2	5	24	0.09	<10	<10	62	<10	66
97 KKA 5547	1.53	480	<1	0.9	39	10	<2	7	30	0.17	<10	<10	78	<10	82
97 KKA 5549	1.16	360	<1	0.99	49	10	<2	6	27	0.11	<10	<10	67	<10	80
97 KKA 5550	1.55	440	2	0.82	89	10	<2	11	33	0.18	<10	<10	127	<10	142
97 KKA 5551	1.62	865	<1	1.07	68	12	<2	11	32	0.12	<10	<10	88	<10	118
97 KKA 5552	1.67	410	1	0.44	43	10	<2	8	62	0.18	<10	<10	82	<10	96
97 KKA 5554	1.11	295	3	1.47	45	12	<2	7	32	0.12	<10	<10	74	<10	70
97 KKA 5555	1.38	410	<1	0.65	37	8	<2	7	39	0.12	<10	<10	68	<10	78
97 KKA 5558	0.79	300	<1	0.93	35	10	<2	5	30	0.09	<10	<10	53	<10	54
97 KKA 5559	2.28	565	<1	0.65	69	16	<2	11	41	0.22	<10	<10	96	<10	126
97 KKA 5560	1.91	715	1	0.64	62	12	<2	9	30	0.2	<10	<10	94	<10	126
97 KKA 5561	2.22	515	<1	0.53	58	10	<2	10	51	0.23	<10	<10	105	<10	130
97 KKA 5562	1.18	740	1	1.35	53	10	<2	7	21	0.15	<10	<10	130	<10	78
97 KKA 5563	0.6	535	3	1.74	33	16	<2	6	15	0.12	<10	<10	75	<10	54
97 KKA 5564	1.4	915	<1	1.52	65	26	<2	7	28	0.1	<10	<10	96	<10	122
97 KKA 5568	2	495	<1	0.66	48	10	<2	9	71	0.19	<10	<10	88	<10	120
97 KKA 5570	1.25	435	1	0.68	34	10	<2	8	51	0.08	<10	<10	85	<10	80
97 KKA 5572	1.66	440	<1	0.7	58	14	<2	9	43	0.16	<10	<10	97	<10	122
97 KKA 5573	0.84	930	1	1.08	47	10	<2	6	22	0.1	<10	<10	89	<10	58
97 KKA 5578	0.66	250	3	0.58	21	12	<2	4	17	0.1	<10	<10	79	<10	46
97 KKA 5579	0.42	175	2	0.82	13	12	<2	2	11	0.04	<10	50	64	<10	36

Appendix B: ICP-AES data (<0.002 mm)

Sample	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppb	K %	La ppm
97 KKA 5580	<0.2	3.97	10	100	1	<2	0.24	<0.5	32	65	324	5.6	10	110	0.44	40
97 KKA 5581	<0.2	3.79	10	90	1	<2	0.28	<0.5	41	56	416	6.4	10	160	0.32	70
97 KKA 5582	<0.2	3.46	8	50	0.5	<2	0.13	<0.5	20	61	98	5.6	10	80	0.24	20
97 KKA 5583	<0.2	4.3	2	240	0.5	<2	0.89	<0.5	19	95	57	4.8	10	10	0.92	40
97 KKA 5584	<0.2	3.97	4	200	0.5	<2	0.86	<0.5	20	94	63	4.8	10	<10	1.04	40
97 KKA 5585	<0.2	3.88	<2	130	0.5	<2	0.34	<0.5	17	73	41	4.5	10	60	0.46	30
97 KKA 5589A	<0.2	2.85	6	140	0.5	<2	0.88	<0.5	16	60	48	3.5	10	30	0.49	40
97 KKA 5589B	<0.2	3.06	2	160	0.5	<2	1.03	<0.5	17	61	51	3.6	10	40	0.53	40
97 KKA 5590	<0.2	3.71	8	160	0.5	<2	0.52	<0.5	21	93	62	4.8	10	10	0.81	40
97 KKA 5591	<0.2	3.94	6	210	0.5	<2	0.83	<0.5	26	91	88	4.6	10	10	0.97	40
97 KKA 5593	<0.2	2.72	2	60	0.5	<2	0.4	<0.5	15	40	50	2.9	<10	110	0.27	30
97 KKA 5594	<0.2	3.27	<2	100	1	<2	0.39	<0.5	17	73	70	3.9	10	90	0.32	50
97 KKA 5595	<0.2	3.82	6	190	0.5	<2	0.87	<0.5	21	90	58	4.6	10	10	0.86	40
97 KKA 5597	<0.2	3.75	6	160	1	<2	0.66	<0.5	25	74	98	4.2	10	10	0.71	50
97 KKA 5598	<0.2	3.78	2	110	0.5	<2	0.57	<0.5	23	74	44	4	10	20	0.46	30
97 KKA 5599	<0.2	4.04	2	120	1	<2	0.5	<0.5	23	80	107	4.1	10	30	0.62	40
97 KKA 5600A	<0.2	3.34	16	100	1	<2	0.42	<0.5	32	71	107	4.1	10	40	0.47	50
97 KKA 5600B	<0.2	3.73	20	110	1.5	<2	0.42	<0.5	35	75	123	4.5	10	70	0.48	50
97 KKA 5601	<0.2	3.37	18	50	0.5	<2	0.27	<0.5	13	58	57	4.3	10	110	0.18	30
97 KKA 5602	<0.2	1.79	6	30	<0.5	<2	0.15	<0.5	5	27	17	2.1	<10	180	0.12	30
97 KKA 5603	<0.2	2.44	6	40	0.5	<2	0.26	<0.5	13	29	69	2.8	<10	80	0.18	30
97 KKA 5604	<0.2	4.44	4	230	1	<2	0.84	<0.5	22	103	46	5.3	10	10	1.14	50
97 KKA 5605	<0.2	5	20	160	1.5	<2	0.39	<0.5	37	105	93	5.4	10	60	0.55	30
97 KKA 5606	<0.2	3.93	24	90	1.5	<2	0.23	<0.5	46	92	90	5.9	10	60	0.5	30
97 KKA 5611	<0.2	3.54	2	180	0.5	<2	0.66	<0.5	22	85	62	4.5	10	10	0.93	40
97 KKA 5614	<0.2	4.12	2	220	0.5	<2	0.55	<0.5	21	96	67	5.1	10	<10	0.86	40
97 KKA 5616	<0.2	4.05	8	260	0.5	<2	1.85	<0.5	22	93	52	4.7	10	10	0.85	40
97 KKA 5617	<0.2	5.2	8	270	1	<2	0.26	<0.5	25	103	94	5.5	10	60	0.57	40
97 KKA 5618	<0.2	3.52	8	130	0.5	<2	0.46	<0.5	34	72	128	4.5	10	40	0.46	70
97 KKA 5619	<0.2	4	4	50	0.5	<2	0.32	<0.5	16	53	109	3.1	<10	160	0.19	40
97 KKA 5620	<0.2	3.68	2	70	0.5	<2	0.37	<0.5	23	71	65	4.1	<10	120	0.22	40
97 KKA 5621	<0.2	3.29	6	140	1	<2	0.4	<0.5	25	97	161	4.4	10	70	0.34	60
97 KKA 5622	<0.2	2.96	2	60	0.5	<2	0.22	<0.5	14	58	80	3.6	<10	120	0.21	40

Appendix B: ICP-AES data (<0.002 mm)

Sample	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	Pb ppm	Sb ppm	Sc ppm	Sr ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Zn ppm
97 KKA 5580	1.19	610	4	0.84	37	26	<2	6	21	0.09	<10	20	102	<10	90
97 KKA 5581	1.55	670	2	0.89	48	34	<2	15	16	0.09	<10	80	198	<10	108
97 KKA 5582	1.06	460	1	0.72	32	14	<2	5	13	0.11	<10	10	132	<10	64
97 KKA 5583	2.17	435	<1	0.38	49	12	<2	9	82	0.19	<10	<10	89	<10	128
97 KKA 5584	2.14	475	1	0.59	51	12	<2	9	62	0.2	<10	<10	92	<10	132
97 KKA 5585	1.54	315	1	0.48	39	8	<2	6	29	0.14	<10	10	84	<10	84
97 KKA 5589A	1.45	375	<1	0.78	34	14	<2	6	66	0.12	<10	<10	63	<10	90
97 KKA 5589B	1.52	390	<1	0.92	35	14	<2	6	77	0.11	<10	<10	66	<10	94
97 KKA 5590	1.89	440	1	0.57	50	16	<2	9	44	0.18	<10	<10	92	<10	110
97 KKA 5591	2.02	435	<1	0.62	55	14	<2	9	63	0.18	<10	<10	83	<10	138
97 KKA 5593	0.79	265	1	1.47	24	10	<2	3	29	0.08	<10	<10	46	<10	62
97 KKA 5594	1.1	305	<1	0.74	33	10	<2	6	35	0.11	<10	20	74	<10	78
97 KKA 5595	1.94	425	1	0.62	49	10	<2	8	69	0.18	<10	<10	84	<10	118
97 KKA 5597	1.77	420	<1	1.01	51	14	2	6	52	0.12	<10	<10	78	<10	128
97 KKA 5598	1.7	425	<1	0.32	42	8	<2	7	41	0.18	<10	<10	78	<10	90
97 KKA 5599	1.65	435	3	0.35	45	14	<2	8	36	0.15	<10	60	80	<10	108
97 KKA 5600A	1.42	535	1	1.01	52	18	<2	6	27	0.1	<10	10	69	<10	114
97 KKA 5600B	1.47	575	1	0.67	54	18	<2	6	29	0.13	<10	<10	74	<10	124
97 KKA 5601	0.81	340	3	1.13	25	22	<2	4	29	0.14	<10	<10	89	<10	62
97 KKA 5602	0.32	170	<1	1.29	13	6	<2	1	98	0.03	<10	<10	29	<10	28
97 KKA 5603	0.52	235	<1	0.67	18	8	<2	3	42	0.06	<10	<10	52	<10	30
97 KKA 5604	2.34	480	1	0.5	50	16	<2	9	83	0.2	<10	<10	99	<10	134
97 KKA 5605	1.87	625	1	0.85	78	22	<2	8	38	0.14	<10	20	96	<10	118
97 KKA 5606	1.97	585	1	0.72	64	40	<2	7	18	0.13	<10	<10	104	<10	180
97 KKA 5611	1.98	440	1	0.62	47	12	<2	8	53	0.17	<10	<10	80	<10	124
97 KKA 5614	2.1	465	<1	0.54	49	14	<2	9	44	0.18	<10	<10	92	<10	122
97 KKA 5616	2.01	450	1	0.49	52	12	<2	8	140	0.17	<10	<10	86	<10	126
97 KKA 5617	1.83	380	1	0.5	63	14	<2	9	38	0.14	<10	10	97	<10	114
97 KKA 5618	1.39	470	<1	1.54	60	22	<2	7	39	0.08	<10	10	76	<10	102
97 KKA 5619	0.74	225	1	1.25	33	10	<2	4	27	0.11	<10	<10	50	<10	58
97 KKA 5620	0.97	390	<1	1.34	41	10	<2	3	29	0.08	<10	<10	66	<10	72
97 KKA 5621	1.37	385	<1	1.02	50	12	<2	8	34	0.1	<10	20	97	<10	78
97 KKA 5622	0.7	180	<1	0.91	28	8	<2	3	19	0.08	<10	<10	61	<10	44

Appendix B: ICP-AES data (<0.002 mm)

Sample	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppb	K %	La ppm
97 KKA 5623	<0.2	4.31	6	80	1.5	<2	0.2	<0.5	18	80	64	4.7	10	130	0.34	40
97 KKA 5624	<0.2	2.27	2	90	0.5	<2	0.51	<0.5	25	49	56	3.3	<10	120	0.35	40
97 KKA 5625	<0.2	2.92	6	170	0.5	<2	0.81	<0.5	32	74	53	3.9	<10	10	0.65	40
97 KKA 5627	<0.2	3.59	6	210	0.5	<2	0.75	<0.5	28	95	96	4.8	10	10	0.91	60
97 KKA 5630	<0.2	3.72	8	110	0.5	<2	0.47	<0.5	21	81	62	4.9	10	50	0.48	40
97 KKA 5632	<0.2	2.65	12	90	0.5	<2	0.68	<0.5	26	47	79	3.1	<10	30	0.36	30
97 KKA 5634	<0.2	3.04	8	70	0.5	<2	0.25	<0.5	15	69	172	3.8	<10	130	0.23	80
97 KKA 5635	<0.2	4.69	8	100	0.5	<2	0.28	<0.5	19	81	109	5.5	10	140	0.39	40
97 KKA 5636	<0.2	2.7	2	120	<0.5	<2	0.82	<0.5	23	61	180	3.7	<10	30	0.46	50
97 KKA 5637	<0.2	2.65	14	80	0.5	<2	0.58	<0.5	20	63	153	4.2	<10	40	0.36	60
97 KKA 5639	<0.2	2.95	2	130	0.5	<2	0.79	<0.5	25	75	127	3.8	10	10	0.59	50
97 KKA 5640	<0.2	2.67	<2	60	0.5	<2	0.47	<0.5	13	40	71	2.9	<10	80	0.22	40
97 KKA 5641	<0.2	3.83	14	60	0.5	<2	0.38	<0.5	46	72	227	4.2	<10	120	0.22	40
97 KKA 5642	<0.2	2.5	6	50	0.5	<2	0.45	<0.5	19	41	105	3	<10	70	0.19	40
97 KKA 5643	<0.2	2.69	8	50	0.5	<2	0.29	<0.5	13	53	96	3.5	<10	100	0.16	40
97 KKA 5644	<0.2	3.49	2	110	1	<2	0.4	<0.5	18	77	62	4.1	10	80	0.36	50
97 KKA 5645	<0.2	2.88	12	80	0.5	<2	0.43	<0.5	52	69	94	4.1	<10	100	0.31	70
97 KKA 5647	<0.2	2.39	4	90	0.5	<2	0.56	<0.5	26	44	86	3.3	<10	30	0.36	60
97 KKA 5648	<0.2	2.89	<2	90	0.5	<2	0.66	<0.5	23	42	115	3	<10	30	0.37	40
97 KKA 5649	<0.2	2.95	72	130	0.5	<2	0.6	<0.5	38	65	193	5.4	<10	30	0.4	70
97 KKA 5650	<0.2	3.92	6	40	0.5	<2	0.14	0.5	16	62	135	4.2	<10	160	0.14	60
97 KKA 5651	<0.2	2.54	2	190	0.5	<2	0.83	0.5	23	55	72	3.4	<10	40	0.44	70
97 KKA 5652	<0.2	3.86	8	70	1	<2	0.19	0.5	17	50	58	4.7	10	100	0.2	40
97 KKA 5653	<0.2	3.48	8	170	0.5	<2	0.61	<0.5	20	88	120	4.6	10	20	0.76	40
97 KKA 5654	<0.2	2.3	26	180	0.5	<2	1.51	1.5	51	66	340	5.4	<10	110	0.12	150
97 KKA 5655	<0.2	3.84	10	120	0.5	<2	0.25	<0.5	21	83	36	4.6	10	50	0.45	50
97 KKA 5656	<0.2	3.29	4	110	0.5	<2	0.37	<0.5	28	58	87	3.6	<10	40	0.38	60
97 KKA 5657	<0.2	3.57	6	90	0.5	<2	0.25	<0.5	27	66	65	4.2	10	80	0.32	70
97 KKA 5658	<0.2	3.05	10	80	0.5	<2	0.68	<0.5	41	66	87	3.6	<10	40	0.31	50
97 KKA 5659	<0.2	4.32	12	160	0.5	<2	0.56	0.5	53	106	181	5	10	60	0.64	100
97 KKA 5661	<0.2	3.05	4	80	0.5	<2	0.4	<0.5	21	66	92	4.4	10	40	0.25	60

Appendix B: ICP-AES data (<0.002 mm)

Sample	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	Pb ppm	Sb ppm	Sc ppm	Sr ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Zn ppm
97 KKA 5623	1.24	330	1	0.68	46	14	<2	6	23	0.12	<10	30	80	<10	78
97 KKA 5624	0.93	415	<1	1.35	33	10	<2	5	34	0.07	<10	<10	58	<10	66
97 KKA 5625	1.59	470	<1	1	54	10	<2	7.	62	0.08	<10	<10	79	<10	104
97 KKA 5627	1.93	460	<1	1.02	58	16	<2	9	51	0.09	<10	<10	90	<10	122
97 KKA 5630	1.5	360	1	0.65	40	18	<2	7	36	0.19	<10	<10	96	<10	92
97 KKA 5632	1.05	315	<1	0.73	46	8	<2	6	45	0.1	<10	<10	55	<10	84
97 KKA 5634	0.62	170	1	1.22	41	6	<2	4	24	0.09	<10	<10	62	<10	48
97 KKA 5635	1.42	325	7	0.83	38	14	<2	5	34	0.18	<10	<10	118	<10	82
97 KKA 5636	1.18	365	<1	1.18	47	8	<2	7	49	0.11	<10	<10	83	<10	72
97 KKA 5637	0.98	330	1	0.8	39	10	<2	7	43	0.12	<10	<10	82	<10	76
97 KKA 5639	1.5	390	1	1.8	59	12	<2	7	60	0.05	<10	<10	80	<10	106
97 KKA 5640	0.73	240	1	0.9	26	6	<2	4	38	0.1	<10	<10	49	<10	46
97 KKA 5641	1.21	625	<1	1.18	70	12	<2	6	25	0.09	<10	<10	69	<10	80
97 KKA 5642	0.71	305	<1	1.1	32	8	<2	4	28	0.09	<10	<10	54	<10	56
97 KKA 5643	0.69	200	1	1.15	25	6	<2	4	23	0.1	<10	<10	68	<10	44
97 KKA 5644	1.19	325	<1	0.7	33	10	<2	6	37	0.12	<10	20	79	<10	84
97 KKA 5645	1.04	645	<1	1.71	40	22	<2	6	29	0.07	<10	<10	67	<10	66
97 KKA 5647	0.93	360	<1	1.06	38	16	<2	5	30	0.06	<10	<10	54	<10	68
97 KKA 5648	0.92	300	1	0.75	44	10	<2	5	37	0.1	<10	<10	52	<10	68
97 KKA 5649	1.3	610	1	1.24	71	8	<2	9	36	0.09	<10	<10	76	<10	92
97 KKA 5650	0.5	190	4	1.64	25	16	<2	4	17	0.1	<10	<10	58	<10	96
97 KKA 5651	1.19	380	<1	1.41	40	10	<2	6	57	0.09	<10	<10	60	<10	74
97 KKA 5652	0.6	220	3	1.3	24	14	<2	4	19	0.12	<10	<10	90	<10	58
97 KKA 5653	1.73	410	<1	0.76	53	8	2	8	40	0.16	<10	<10	81	<10	106
97 KKA 5654	0.58	1940	1	2.64	40	30	<2	7	78	0.06	<10	<10	83	<10	52
97 KKA 5655	1.37	315	<1	0.73	44	12	<2	7	39	0.14	<10	<10	76	<10	78
97 KKA 5656	1.04	460	<1	0.96	41	12	<2	6	30	0.1	<10	<10	58	<10	76
97 KKA 5657	0.92	380	3	1.5	34	14	<2	6	29	0.11	<10	<10	76	<10	62
97 KKA 5658	1.15	520	<1	1.31	55	8	<2	7	39	0.04	<10	<10	62	<10	66
97 KKA 5659	1.63	1045	1	1.75	76	22	<2	9	35	0.06	<10	<10	83	<10	126
97 KKA 5661	0.92	260	1	0.85	37	10	<2	6	29	0.13	<10	<10	87	<10	58

Appendix C: INAA data (<0.063 mm)

Sample	Au ppb	Ag ppm	As ppm	Ba ppm	Br ppm	Ca %	Co ppm	Cr ppm	Cs ppm	Fe %	Hf ppm	Hg ppm	Ir ppm	Mo ppm
Detection limit	2	5	0.5	50	0.5	1	1	5	1	0.01	1	1	5	1
97 KKA 5515	8	<5	7	520	11	2	23	140	2	3.85	8	<1	<5	<1
97 KKA 5523	<3	<5	6.9	750	18	<1	20	160	3	4.35	8	<1	<5	<1
97 KKA 5524	5	<5	3.1	680	6.7	3	17	87	1	3.6	7	<1	<5	<1
97 KKA 5525	3	<5	2.5	450	5.1	3	11	39	<1	2.61	8	<1	<5	<1
97 KKA 5528	5	<5	1.8	540	7.1	3	11	47	<1	2.96	10	<1	<5	<1
97 KKA 5529	5	<5	1.7	550	18	2	12	42	2	2.94	7	<1	<5	<1
97 KKA 5530	<2	<5	6.3	700	9.7	2	18	77	2	3.96	6	<1	<5	10
97 KKA 5541	5	<5	3.3	510	8.5	3	16	64	2	3.37	7	<1	<5	<1
97 KKA 5544	<2	<5	2.3	620	2.8	2	8	50	<1	2.12	9	<1	<5	<1
97 KKA 5545	<2	<5	1.7	620	7.4	2	11	62	1	2.82	10	<1	<5	<1
97 KKA 5546 A	<2	<5	<0.5	570	3.7	2	7	51	<1	2.12	9	<1	<5	<1
97 KKA 5546 B	<2	<5	<0.5	550	3.8	2	8	51	<1	2.2	10	<1	<5	<1
97 KKA 5547	<2	<5	1.4	590	5.9	2	10	47	<1	2.43	9	<1	<5	<1
97 KKA 5549	<2	<5	1.2	670	2.3	2	8	50	<1	2.22	12	<1	<5	<1
97 KKA 5550	3	<5	1.8	680	3.1	2	10	52	<1	2.47	11	<1	<5	5
97 KKA 5551	3	<5	3.2	720	4.4	2	14	68	1	3.09	10	1	<5	<1
97 KKA 5552	3	<5	2.9	800	4.8	2	10	62	1	2.62	8	<1	<5	5
97 KKA 5554	<2	<5	2	670	9.7	2	11	60	<1	2.46	11	<1	<5	<1
97 KKA 5555	<2	<5	1.9	650	1.6	2	8	53	<1	2.25	10	<1	<5	<1
97 KKA 5558	3	<5	2	690	1.3	2	7	52	<1	2.16	12	<1	<5	<1
97 KKA 5559	5	<5	5.2	740	6.6	2	18	87	2	3.79	8	<1	<5	<1
97 KKA 5560	<2	<5	5.2	440	5.9	2	12	50	<1	2.29	6	<1	<5	<1
97 KKA 5561	<2	<5	3.6	770	6.8	2	17	92	2	3.87	7	<1	<5	<1
97 KKA 5562	11	<5	5.1	410	13	2	23	110	<1	4.3	8	<1	<5	<1
97 KKA 5563	19	<5	7.1	500	13	2	15	62	<1	3.44	13	<1	<5	<1
97 KKA 5564	<2	<5	12	520	7.9	2	17	69	<1	3.66	12	<1	<5	4
97 KKA 5568	<2	<5	1.7	610	6.1	1	13	76	2	3.27	10	<1	<5	<1
97 KKA 5570	<2	<5	2.5	520	0.7	2	7	54	<1	2.13	11	<1	<5	<1
97 KKA 5572	<2	<5	1.8	600	1.7	2	9	57	<1	2.64	11	<1	<5	<1
97 KKA 5573	<2	<5	4	490	6.1	2	11	46	<1	2.49	10	<1	<5	2
97 KKA 5578	6	<5	2.5	550	38	1	8	53	2	2.72	9	<1	<5	<1

Appendix C: INAA data (<0.063 mm)

Sample	Na %	Ni ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn %	Sr %	Ta ppm	Th ppm	U ppm	W ppm	Zn ppm	La ppm
Detection limit	0.01	20	5	0.1	0.1	3	0.01	0.05	0.5	0.2	0.5	1	50	0.5
97 KKA 5515	2.2	<20	46	0.3	13	<3	<0.01	<0.05	<0.5	7.8	1.2	<1	74	31
97 KKA 5523	1.72	<20	98	0.4	16	<3	<0.01	<0.05	<0.5	20	6.9	<1	148	67
97 KKA 5524	1.94	120	67	0.2	13	<3	<0.01	<0.05	<0.5	14	2.5	<1	95	44
97 KKA 5525	2.29	<20	42	<0.1	9.5	<3	<0.01	<0.05	<0.5	7.1	1.1	<1	<50	24
97 KKA 5528	2.31	<20	69	<0.1	11	4	<0.01	<0.05	<0.5	7.3	1.4	<1	106	31
97 KKA 5529	2.44	<20	61	<0.1	10	<3	<0.01	0.06	1.4	8	4	<1	<50	31
97 KKA 5530	2.08	<20	76	<0.1	12	5	<0.01	<0.05	<0.5	16	1.3	<1	88	50
97 KKA 5541	2.03	<20	51	<0.1	12	<3	<0.01	<0.05	<0.5	8.6	8.9	<1	94	33
97 KKA 5544	2	100	63	<0.1	8.2	<3	<0.01	<0.05	<0.5	6.8	1.6	<1	<50	23
97 KKA 5545	2.08	100	78	<0.1	9.9	<3	<0.01	0.08	<0.5	11	3.2	<1	<50	45
97 KKA 5546 A	1.94	<20	56	<0.1	8.2	<3	<0.01	<0.05	<0.5	7.4	1.2	<1	<50	26
97 KKA 5546 B	2.07	<20	59	<0.1	9	<3	<0.01	<0.05	<0.5	7.4	1.8	<1	58	28
97 KKA 5547	2.07	<20	64	<0.1	9	<3	<0.01	0.05	1.1	8.7	1.4	<1	<50	27
97 KKA 5549	2.02	<20	46	<0.1	9	<3	<0.01	<0.05	1.1	9.5	1.8	<1	75	28
97 KKA 5550	2.05	<20	49	<0.1	11	3	<0.01	<0.05	0.7	11	<0.5	<1	94	39
97 KKA 5551	2.05	<20	56	<0.1	12	<3	<0.01	<0.05	<0.5	10	1.8	<1	71	34
97 KKA 5552	2.06	91	78	<0.1	9.7	<3	<0.01	<0.05	<0.5	12	2	<1	84	34
97 KKA 5554	1.89	<20	67	<0.1	9.3	<3	<0.01	<0.05	<0.5	12	1.3	<1	60	40
97 KKA 5555	2	<20	51	<0.1	9	<3	<0.01	<0.05	<0.5	8.2	<0.5	<1	64	28
97 KKA 5558	2.05	58	50	0.2	8.8	<3	<0.01	<0.05	<0.5	8.8	1.6	<1	<50	27
97 KKA 5559	2.02	150	72	0.3	13	<3	<0.01	<0.05	<0.5	15	<0.5	<1	153	47
97 KKA 5560	1.53	<20	43	0.1	8	<3	<0.01	<0.05	<0.5	5.7	<0.5	<1	60	19
97 KKA 5561	1.83	<20	100	<0.1	13	<3	<0.01	<0.05	<0.5	16	2.5	<1	149	49
97 KKA 5562	2.26	<20	41	<0.1	16	<3	<0.01	0.07	1.1	7.4	1	<1	113	30
97 KKA 5563	2.14	<20	57	0.2	11	<3	<0.01	<0.05	0.9	12	2.4	<1	97	33
97 KKA 5564	2.07	<20	44	<0.1	12	<3	<0.01	<0.05	<0.5	10	1.2	<1	110	29
97 KKA 5568	2.17	<20	76	<0.1	11	3	<0.01	<0.05	0.7	11	1.4	<1	97	36
97 KKA 5570	2.31	<20	40	0.1	9.9	<3	<0.01	<0.05	0.6	8.2	1.6	<1	<50	29
97 KKA 5572	2.21	<20	52	<0.1	10	<3	<0.01	<0.05	1.2	10	1.2	<1	85	38
97 KKA 5573	2.13	<20	41	<0.1	9.1	<3	<0.01	<0.05	0.8	6.6	1.6	<1	<50	25
97 KKA 5578	1.9	<20	89	0.2	9.5	<3	<0.01	<0.05	1.5	12	3.7	<1	87	33

Appendix C: INAA data (<0.063 mm)

Sample	Ce ppm	Nd ppm	Sm ppm	Eu ppm	Tb ppm	Yb ppm	Lu ppm	Mass gm
Detection limit	3	5	0.1	0.2	0.5	0.2	0.05	
97 KKA 5515	74	23	4.6	1.3	0.7	1.9	0.27	27.43
97 KKA 5523	110	49	7.9	1.8	<0.5	2.3	0.36	19.73
97 KKA 5524	86	36	5.5	1.3	<0.5	2.1	0.3	24.83
97 KKA 5525	52	20	3.7	1.1	<0.5	1.8	0.24	28.98
97 KKA 5528	61	26	4.6	1.3	<0.5	2.1	0.34	29.94
97 KKA 5529	57	23	4	1.2	<0.5	1.6	0.22	24.01
97 KKA 5530	110	38	6.5	1.2	<0.5	1.9	0.28	18.25
97 KKA 5541	67	23	4.6	1.3	0.5	1.6	0.25	26.5
97 KKA 5544	47	16	3.6	1.1	<0.5	1.8	0.26	35.09
97 KKA 5545	82	34	5.4	1.3	<0.5	2	0.27	29.87
97 KKA 5546 A	53	19	3.8	1	0.6	1.8	0.26	32.2
97 KKA 5546 B	55	21	4	1.1	0.5	1.9	0.28	33.55
97 KKA 5547	56	22	3.9	1.1	<0.5	1.8	0.25	31.73
97 KKA 5549	58	17	4.3	1.1	<0.5	2	0.29	32.7
97 KKA 5550	74	31	5.6	1.4	0.7	2.2	0.35	31.16
97 KKA 5551	70	24	4.7	1.2	<0.5	2.1	0.31	30.53
97 KKA 5552	62	25	4.6	1.3	<0.5	1.9	0.26	26.97
97 KKA 5554	74	29	5.1	1.3	0.7	2	0.3	29.11
97 KKA 5555	54	23	4.2	1.1	<0.5	1.9	0.29	29.64
97 KKA 5558	55	24	4.1	1.2	0.6	2	0.29	33.14
97 KKA 5559	90	39	6	1.4	<0.5	2.1	0.32	24.36
97 KKA 5560	37	15	2.8	0.8	<0.5	1.2	0.18	36.9
97 KKA 5561	92	35	6.2	1.3	<0.5	2	0.31	21.43
97 KKA 5562	69	23	4.6	1.2	<0.5	1.9	0.27	27.36
97 KKA 5563	65	27	4.7	1.2	<0.5	2.1	0.32	32.55
97 KKA 5564	62	25	4.4	1.2	0.6	2.1	0.31	30.21
97 KKA 5568	72	33	5.2	1.3	<0.5	1.9	0.31	24.97
97 KKA 5570	56	24	4.1	1.2	<0.5	2	0.29	31.75
97 KKA 5572	68	36	5.3	1.3	0.6	2.2	0.32	30.25
97 KKA 5573	51	22	3.7	1	<0.5	1.7	0.23	34.67
97 KKA 5578	66	23	5	1.1	<0.5	2	0.29	27.23

Appendix C: INAA data (<0.063 mm)

Sample	Au ppb	Ag ppm	As ppm	Ba ppm	Br ppm	Ca %	Co ppm	Cr ppm	Cs ppm	Fe %	Hf ppm	Hg ppm	Ir ppm	Mo ppm
97 KKA 5579	5	<5	1.3	450	38	1	7	39	2	2.13	9	<1	<5	7
97 KKA 5580	<2	<5	1.6	490	14	1	11	45	<1	2.64	8	<1	<5	2
97 KKA 5581	<2	<5	3	500	14	2	20	44	2	3.7	7	<1	<5	<1
97 KKA 5582	<2	<5	2	530	26	<1	11	47	2	2.71	8	<1	<5	<1
97 KKA 5583	<2	<5	3.7	720	12	<1	16	89	3	3.96	6	<1	<5	<1
97 KKA 5584	<2	<5	3.4	740	6.4	3	16	88	3	3.82	6	<1	<5	<1
97 KKA 5585	<2	<5	3	530	16	2	9	49	2	2.37	7	<1	<5	<1
97 KKA 5589 A	3	<5	2.1	560	10	2	8	44	<1	2.3	9	<1	<5	<1
97 KKA 5589 B	5	<5	3	580	11	3	8	46	1	2.25	9	<1	<5	3
97 KKA 5590	2	<5	1.8	700	3	2	10	62	1	2.59	9	<1	<5	<1
97 KKA 5591	<2	<5	1.6	600	4	2	10	60	1	2.66	10	<1	<5	<1
97 KKA 5593	<2	<5	1.3	520	8.6	2	6	39	<1	1.93	9	<1	<5	<1
97 KKA 5594	<2	<5	2.1	430	9.2	<1	8	46	3	2.13	9	<1	<5	<1
97 KKA 5595	2	<5	2.9	680	3.4	2	10	61	1	2.58	10	<1	<5	3
97 KKA 5597	3	<5	3.1	570	3.6	2	8	55	2	2.47	12	<1	<5	3
97 KKA 5598	<2	<5	4.3	720	12	<1	14	69	3	3.07	8	<1	<5	2
97 KKA 5599	11	<5	5	650	17	<1	18	82	4	3.48	6	<1	<5	<1
97 KKA 5600 A	3	<5	5.4	690	5.1	3	10	63	1	2.64	9	<1	<5	2
97 KKA 5600 B	<2	<5	5.9	730	5.8	2	11	66	2	2.67	9	<1	<5	3
97 KKA 5601	3	<5	4	590	18	1	7	51	1	2.35	8	<1	<5	2
97 KKA 5602	2	<5	3.8	260	17	<1	3	19	<1	1.05	3	<1	<5	<1
97 KKA 5603	<2	<5	2.3	300	7.6	1	4	31	1	1.75	8	<1	<5	<1
97 KKA 5611	<2	<5	2.5	580	5.6	2	9	50	2	2.35	8	<1	<5	2
97 KKA 5614	<2	<5	3.5	610	5	<1	12	62	2	2.83	7	<1	<5	2
97 KKA 5616	3	<5	4.4	610	15	4	14	71	3	3.07	8	<1	<5	<1
97 KKA 5617	5	<5	10	910	45	<1	22	120	4	5.92	5	<1	<5	<1
97 KKA 5618	2	<5	2.7	530	3.4	2	10	49	1	2.39	10	<1	<5	<1
97 KKA 5619	<2	<5	2.7	500	11	2	7	51	<1	2.28	10	<1	<5	3
97 KKA 5620	<2	<5	1.8	560	8	2	10	62	1	2.86	14	<1	<5	<1
97 KKA 5621	2	<5	2	590	11	2	10	62	2	2.49	9	<1	<5	<1
97 KKA 5622	3	<5	<0.5	480	14	2	7	47	1	2.17	11	<1	<5	<1
97 KKA 5623	<2	<5	2.5	530	34	1	11	63	2	2.8	9	<1	<5	<1

Appendix C: INAA data (<0.063 mm)

Sample	Na %	Ni ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn %	Sr %	Ta ppm	Th ppm	U ppm	W ppm	Zn ppm	La ppm
97 KKA 5579	1.99	70	89	0.1	7.6	<3	<0.01	<0.05	<0.5	20	11	<1	<50	56
97 KKA 5580	2	<20	81	<0.1	9.1	<3	<0.01	<0.05	<0.5	11	3	<1	63	30
97 KKA 5581	1.95	<20	96	<0.1	13	<3	<0.01	<0.05	<0.5	14	18	<1	92	50
97 KKA 5582	2	<20	99	<0.1	8.7	<3	<0.01	<0.05	1.4	11	4.9	<1	<50	30
97 KKA 5583	2.09	<20	150	<0.1	13	<3	<0.01	<0.05	<0.5	19	2.2	<1	124	52
97 KKA 5584	1.98	91	110	<0.1	12	<3	<0.01	<0.05	1.1	15	1.8	<1	123	42
97 KKA 5585	2.19	75	110	<0.1	8.5	<3	<0.01	<0.05	1.2	12	5.2	<1	<50	35
97 KKA 5589 A	2.39	<20	87	<0.1	8.9	<3	<0.01	<0.05	<0.5	13	3	<1	<50	35
97 KKA 5589 B	2.3	63	90	<0.1	8.8	<3	<0.01	<0.05	0.7	13	2.5	<1	69	34
97 KKA 5590	2.14	<20	76	<0.1	10	<3	<0.01	<0.05	0.9	11	2.4	<1	82	37
97 KKA 5591	2.34	<20	79	0.2	10	<3	<0.01	0.05	<0.5	10	2.7	<1	99	34
97 KKA 5593	2.25	<20	77	<0.1	7.5	<3	<0.01	<0.05	0.9	9.6	2.1	<1	83	24
97 KKA 5594	2.22	<20	110	0.2	9	<3	<0.01	0.05	<0.5	11	4.4	<1	63	31
97 KKA 5595	2.24	<20	48	0.2	10	<3	<0.01	<0.05	<0.5	9.4	2	<1	63	33
97 KKA 5597	2.26	<20	83	<0.1	9.9	<3	<0.01	<0.05	<0.5	11	2.7	<1	86	32
97 KKA 5598	2.16	<20	120	0.3	11	<3	<0.01	0.05	<0.5	13	3.5	<1	106	36
97 KKA 5599	1.88	<20	130	<0.1	12	<3	<0.01	<0.05	<0.5	19	43	<1	<50	68
97 KKA 5600 A	2.04	70	75	<0.1	10	3	<0.01	<0.05	0.6	11	2.9	<1	96	37
97 KKA 5600 B	2.08	<20	79	<0.1	11	<3	<0.01	0.05	<0.5	12	2.7	<1	93	38
97 KKA 5601	2	<20	47	<0.1	8.4	<3	<0.01	<0.05	1.1	6.3	2.7	<1	56	22
97 KKA 5602	0.97	<20	41	0.4	3.4	<3	<0.01	<0.05	<0.5	4.5	1.2	<1	<50	14
97 KKA 5603	1.59	<20	65	0.4	5.8	<3	<0.01	<0.05	1	7.9	2.7	<1	<50	25
97 KKA 5611	2.43	<20	95	0.2	9	<3	<0.01	0.05	1.1	12	2.3	<1	69	36
97 KKA 5614	2.1	<20	120	<0.1	9.5	<3	<0.01	<0.05	<0.5	15	4.3	<1	109	44
97 KKA 5616	1.71	<20	97	<0.1	10	<3	<0.01	<0.05	<0.5	13	2.6	<1	69	38
97 KKA 5617	1.19	140	140	<0.1	16	<3	<0.01	<0.05	<0.5	20	15	<1	<50	79
97 KKA 5618	2.3	<20	61	<0.1	9	<3	<0.01	<0.05	1.2	10	2.4	<1	86	35
97 KKA 5619	2.13	50	29	0.2	8.5	<3	<0.01	<0.05	0.6	6.8	1.5	<1	76	24
97 KKA 5620	2	<20	38	<0.1	10	<3	<0.01	<0.05	<0.5	9.9	2.5	<1	73	31
97 KKA 5621	2.1	<20	59	<0.1	9.9	<3	<0.01	<0.05	1.1	9.6	5.1	<1	69	37
97 KKA 5622	2.18	<20	58	<0.1	8.4	<3	<0.01	<0.05	<0.5	9.9	3.4	<1	65	29
97 KKA 5623	2.01	<20	75	<0.1	10	<3	<0.01	<0.05	<0.5	10	7.4	<1	81	34

Sample	Ce ppm	Nd ppm	Sm ppm	Eu ppm	Tb ppm	Yb ppm	Lu ppm	Mass gm
97 KKA 5579	100	40	7.9	1.4	<0.5	1.6	0.24	25.07
97 KKA 5580	68	28	5	1.1	<0.5	1.6	0.25	29.34
97 KKA 5581	96	42	8	1.6	0.6	2.1	0.29	26.43
97 KKA 5582	62	25	4.6	1.1	<0.5	1.5	0.23	26.66
97 KKA 5583	100	37	7.2	1.4	<0.5	1.7	0.28	21.49
97 KKA 5584	88	33	5.9	1.3	0.5	1.9	0.25	20.69
97 KKA 5585	70	29	5.3	1	<0.5	1.5	0.21	22.88
97 KKA 5589 A	71	25	5.6	1.2	<0.5	2	0.27	26.03
97 KKA 5589 B	73	27	5.7	1.3	<0.5	1.7	0.27	23.12
97 KKA 5590	72	30	5.2	1.3	<0.5	2	0.29	26.82
97 KKA 5591	66	27	5.1	1.3	<0.5	1.9	0.29	28.44
97 KKA 5593	50	21	4	1	<0.5	1.6	0.25	34.87
97 KKA 5594	64	27	5.1	1.1	<0.5	1.7	0.23	26.4
97 KKA 5595	63	28	4.9	1.3	<0.5	2.1	0.28	29.49
97 KKA 5597	65	29	5.2	1.2	<0.5	2	0.29	28.14
97 KKA 5598	78	30	5.5	1.3	<0.5	1.7	0.24	19.8
97 KKA 5599	130	52	9.8	1.8	1	1.6	0.34	16.72
97 KKA 5600 A	71	30	5.3	1.2	<0.5	2.2	0.27	30.48
97 KKA 5600 B	75	28	5.5	1.3	<0.5	2.1	0.32	30.37
97 KKA 5601	48	22	3.6	1	<0.5	1.6	0.21	30.49
97 KKA 5602	26	11	1.9	0.6	<0.5	0.8	0.12	31.82
97 KKA 5603	48	20	3.7	0.9	<0.5	1.5	0.24	31.29
97 KKA 5611	71	28	5.6	1.2	<0.5	1.8	0.24	27.74
97 KKA 5614	79	36	6.6	1.3	<0.5	1.6	0.21	23.04
97 KKA 5616	79	33	5.8	1.3	0.7	1.8	0.27	24.47
97 KKA 5617	140	56	11	1.9	<0.5	2.6	0.38	15.84
97 KKA 5618	67	31	5.2	1.3	0.5	1.9	0.29	33.55
97 KKA 5619	49	23	3.8	1.1	<0.5	1.5	0.26	35.9
97 KKA 5620	63	25	4.7	1.1	0.6	2.1	0.33	32.05
97 KKA 5621	74	29	5.5	1.3	0.8	1.9	0.28	29.18
97 KKA 5622	57	22	4.4	1.1	<0.5	1.8	0.27	34.19
97 KKA 5623	68	28	5.3	1.3	<0.5	1.8	0.26	26.88

Appendix C: INAA data (<0.063 mm)

Sample	Au ppb	Ag ppm	As ppm	Ba ppm	Br ppm	Ca %	Co ppm	Cr ppm	Cs ppm	Fe %	Hf ppm	Hg ppm	Ir ppm	Mo ppm
97 KKA 5624	6	<5	1.3	570	3.3	3	7	42	<1	2.04	10	<1	<5	3
97 KKA 5625	3	<5	1.8	640	3.5	2	8	48	<1	2.37	12	<1	<5	<1
97 KKA 5627	<2	<5	1.6	730	3.8	2	9	66	<1	2.76	12	<1	<5	<1
97 KKA 5630	<2	<5	2	590	9.2	1	9	52	1	2.48	9	<1	<5	<1
97 KKA 5632	<2	<5	2.8	620	4	2	7	48	<1	2.27	12	<1	<5	<1
97 KKA 5634	<2	<5	2	620	8.3	2	8	57	<1	2.52	13	<1	<5	<1
97 KKA 5635	<2	<5	3.6	510	19	2	12	65	1	3.37	10	<1	<5	<1
97 KKA 5636	<2	<5	2.3	590	3.3	3	8	46	<1	2.2	11	1	<5	<1
97 KKA 5637	4	<5	2.5	550	2	3	7	45	<1	2.19	10	<1	<5	2
97 KKA 5639	4	<5	1.5	560	3.6	3	8	52	<1	2.41	11	<1	<5	<1
97 KKA 5640	4	5	<0.5	610	5	2	7	44	<1	2.19	10	<1	<5	<1
97 KKA 5641	2	<5	3.9	610	9.1	2	13	53	<1	2.8	12	<1	<5	<1
97 KKA 5642	<2	<5	2.6	500	5.3	2	9	46	<1	2.45	10	<1	<5	<1
97 KKA 5643	<2	<5	1.8	530	9.6	3	6	51	<1	2.43	12	<1	<5	<1
97 KKA 5644	6	<5	1.8	580	4.4	2	7	47	<1	2.01	9	<1	<5	<1
97 KKA 5645	2	<5	1.8	520	3.7	2	11	53	<1	2.61	11	<1	<5	4
97 KKA 5647	<2	<5	1.8	610	2.2	2	8	50	<1	2.43	12	<1	<5	<1
97 KKA 5648	6	<5	1.7	560	2.9	2	7	47	<1	2.2	12	<1	<5	<1
97 KKA 5649	42	<5	8.5	630	2.5	2	10	46	<1	2.29	11	<1	<5	<1
97 KKA 5650	3	<5	3.3	580	22	2	14	67	2	3.83	15	<1	<5	<1
97 KKA 5651	<2	<5	0.7	670	7.7	3	10	59	<1	2.78	12	<1	<5	<1
97 KKA 5652	7	<5	1.2	570	9.9	2	9	54	1	2.55	11	<1	<5	2
97 KKA 5653	7	<5	2.9	590	8.6	2	17	79	2	3.46	8	<1	<5	<1
97 KKA 5654	13	<5	8.5	430	52	3	29	92	2	5.39	6	<1	<5	<1
97 KKA 5655	<2	<5	2.1	640	6.5	2	9	61	<1	2.78	12	<1	<5	<1
97 KKA 5656	<2	<5	2	640	4.2	2	9	55	<1	2.34	10	<1	<5	<1
97 KKA 5657	2	<5	1.3	640	9.4	2	10	56	<1	2.63	11	<1	<5	2
97 KKA 5658	3	<5	1.6	610	3.1	2	9	43	<1	2.08	9	<1	<5	<1
97 KKA 5659	4	<5	2.3	640	7.7	2	16	62	2	3.11	7	<1	<5	<1
97 KKA 5661	<2	<5	<0.5	640	3.7	2	8	48	<1	2.16	10	<1	<5	<1

Appendix C: INAA data (<0.063 mm)

Sample	Na %	Ni ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn %	Sr %	Ta ppm	Th ppm	U ppm	W ppm	Zn ppm	La ppm
97 KKA 5624	2.25	<20	50	<0.1	7.9	<3	<0.01	<0.05	1	7	1.4	<1	<50	23
97 KKA 5625	2.22	<20	56	<0.1	9.3	<3	<0.01	<0.05	0.8	8.5	1.1	<1	<50	29
97 KKA 5627	2.02	<20	83	<0.1	10	<3	<0.01	<0.05	<0.5	15	2.1	<1	76	42
97 KKA 5630	1.99	<20	72	0.3	9.1	<3	<0.01	<0.05	<0.5	9.1	2.6	<1	73	29
97 KKA 5632	2.23	<20	51	<0.1	9.6	<3	<0.01	<0.05	<0.5	8	1.5	<1	53	28
97 KKA 5634	2.09	<20	42	<0.1	10	<3	<0.01	<0.05	<0.5	10	1.9	<1	70	37
97 KKA 5635	1.84	<20	68	0.2	11	<3	<0.01	<0.05	<0.5	9.3	2.4	<1	129	32
97 KKA 5636	2.19	<20	57	<0.1	9.3	<3	<0.01	0.07	0.8	8.7	2.3	<1	54	30
97 KKA 5637	2.34	<20	54	0.2	9	<3	<0.01	<0.05	1.1	8.1	1.9	<1	75	29
97 KKA 5639	2.12	90	54	<0.1	9.8	<3	<0.01	0.07	<0.5	9.2	1.9	<1	66	33
97 KKA 5640	2.12	<20	37	<0.1	8.8	<3	<0.01	<0.05	<0.5	6.8	1.8	<1	66	24
97 KKA 5641	2.33	<20	49	<0.1	11	<3	<0.01	<0.05	<0.5	8.2	1.5	<1	89	26
97 KKA 5642	2.14	59	45	0.3	9.2	<3	<0.01	<0.05	1	7.6	1.3	<1	<50	25
97 KKA 5643	2.06	<20	49	0.2	9.7	<3	<0.01	0.06	<0.5	8.2	2.5	<1	<50	28
97 KKA 5644	2.02	<20	51	<0.1	8.5	<3	<0.01	<0.05	1.2	7.1	1.5	<1	75	27
97 KKA 5645	2.16	<20	52	0.2	9.6	<3	<0.01	<0.05	<0.5	9	2.1	<1	90	31
97 KKA 5647	2.14	64	56	<0.1	9.8	<3	<0.01	<0.05	<0.5	11	1.9	<1	69	31
97 KKA 5648	2.13	<20	49	<0.1	9.1	<3	<0.01	<0.05	1.2	9.1	1.8	<1	87	27
97 KKA 5649	2.08	<20	63	<0.1	9.3	4	<0.01	<0.05	0.9	8.9	1.9	<1	94	32
97 KKA 5650	1.84	<20	52	<0.1	12	<3	<0.01	<0.05	<0.5	14	2.7	<1	154	50
97 KKA 5651	2.18	<20	52	<0.1	10	<3	<0.01	<0.05	0.8	12	1.8	<1	<50	44
97 KKA 5652	2.04	<20	61	<0.1	9.5	<3	<0.01	<0.05	<0.5	10	2.5	<1	81	28
97 KKA 5653	1.85	<20	87	0.5	12	<3	<0.01	<0.05	<0.5	14	2.9	<1	256	46
97 KKA 5654	1.63	<20	77	<0.1	17	<3	<0.01	<0.05	1.6	18	3.2	<1	190	100
97 KKA 5655	1.97	<20	70	0.1	9.9	<3	<0.01	<0.05	<0.5	12	1.1	<1	95	37
97 KKA 5656	2.01	<20	61	<0.1	8.5	<3	<0.01	0.05	0.7	10	2.1	<1	<50	33
97 KKA 5657	2.07	<20	56	<0.1	9.4	<3	<0.01	<0.05	<0.5	11	1.8	<1	68	36
97 KKA 5658	2.12	<20	50	0.1	8.2	3	<0.01	<0.05	<0.5	6.8	1.3	<1	81	24
97 KKA 5659	2.21	<20	88	<0.1	10	<3	<0.01	<0.05	1.3	16	1.5	<1	108	50
97 KKA 5661	1.98	61	49	<0.1	8.1	<3	<0.01	<0.05	<0.5	8.9	1.8	<1	57	28

Appendix C: INAA data (<0.063 mm)

Sample	Ce ppm	Nd ppm	Sm ppm	Eu ppm	Tb ppm	Yb ppm	Lu ppm	Mass gm
97 KKA 5624	45	19	3.6	1	<0.5	1.5	0.27	34.45
97 KKA 5625	57	24	4.5	1.2	<0.5	2	0.28	34.58
97 KKA 5627	80	32	5.7	1.3	0.7	2.3	0.36	33.01
97 KKA 5630	54	22	4.1	1	<0.5	1.5	0.26	27.15
97 KKA 5632	56	26	4.5	1.2	<0.5	2	0.3	36.26
97 KKA 5634	70	29	5.4	1.4	0.9	2.4	0.34	32.63
97 KKA 5635	64	26	4.8	1.2	0.6	2	0.28	28.12
97 KKA 5636	59	22	4.4	1.2	<0.5	2	0.28	30.43
97 KKA 5637	58	27	4.2	1.2	<0.5	2	0.29	31.69
97 KKA 5639	63	28	4.8	1.3	<0.5	2	0.28	31.61
97 KKA 5640	48	18	3.8	1.1	<0.5	1.8	0.27	31.83
97 KKA 5641	61	23	4	1.2	<0.5	1.9	0.3	28.95
97 KKA 5642	51	20	3.8	1.1	<0.5	2	0.28	31.48
97 KKA 5643	54	23	4.3	1.2	<0.5	2	0.28	30.62
97 KKA 5644	54	22	4	1.1	<0.5	1.7	0.25	31.58
97 KKA 5645	61	23	4.3	1	<0.5	2	0.28	34.35
97 KKA 5647	61	25	4.5	1.1	<0.5	2	0.29	35.96
97 KKA 5648	54	18	4.2	1.1	<0.5	2	0.34	35.54
97 KKA 5649	61	28	4.5	1.1	0.6	2	0.3	33.22
97 KKA 5650	92	35	6.4	1.5	<0.5	2.6	0.34	30.78
97 KKA 5651	80	34	5.3	1.3	0.5	2.2	0.33	30.53
97 KKA 5652	55	24	4.2	1	<0.5	2	0.29	34.37
97 KKA 5653	81	40	6.1	1.5	<0.5	2	0.28	21.13
97 KKA 5654	190	66	11	2	<0.5	2.7	0.38	22.43
97 KKA 5655	71	27	4.8	1.1	<0.5	2.1	0.28	32.56
97 KKA 5656	59	25	4.3	1.1	<0.5	2	0.27	35.58
97 KKA 5657	68	27	4.7	1.2	<0.5	1.8	0.31	34.51
97 KKA 5658	48	19	3.6	0.9	<0.5	1.6	0.25	38
97 KKA 5659	98	37	5.5	1.2	<0.5	1.7	0.25	29.09
97 KKA 5661	55	23	4	1	<0.5	1.8	0.27	31.91

Appendix D: Standards and duplicates for ICP-AES analyses (<0.002 mm)

Sample	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppb	K %
Detection limit	0.2	0.01	2	10	0.5	2	0.01	0.5	1	1	1	0.01	10	1	0.01
97 KKA 5545	<0.2	4.47	4	160	0.5	<2	0.5	<0.5	23	100	253	4.66	10	50	0.61
97 KKA 5545 dup	<0.2	4.68	6	170	0.5	<2	0.6	0.5	25	104	267	4.99	10	50	0.67
97 KKA 5559	<0.2	4.32	4	200	0.5	<2	0.6	<0.5	28	116	134	5.5	10	10	0.75
97 KKA 5559 dup	<0.2	3.99	8	190	0.5	<2	0.5	<0.5	28	112	129	5.4	10	10	0.72
97 KKA 5578	<0.2	3.49	8	60	0.5	<2	0.1	<0.5	11	51	80	4.12	10	170	0.22
97 KKA 5578 dup	<0.2	3.73	8	60	1	<2	0.1	<0.5	13	55	95	4.54	10	100	0.21
97 KKA 5589B	<0.2	3.06	2	160	0.5	<2	1	<0.5	17	61	51	3.62	10	40	0.53
97 KKA 5589B dup	<0.2	2.84	4	150	0.5	<2	0.9	<0.5	18	58	51	3.6	10	30	0.49
97 KKA 5603	<0.2	2.44	6	40	0.5	<2	0.3	<0.5	13	29	69	2.76	<10	80	0.18
97 KKA 5603 dup	<0.2	2.05	6	30	0.5	<2	0.2	<0.5	13	26	60	2.51	<10	50	0.13
97 KKA 5619	<0.2	4	4	50	0.5	<2	0.3	<0.5	16	53	109	3.09	<10	160	0.19
97 KKA 5619 dup	<0.2	3.84	4	50	0.5	<2	0.3	<0.5	16	51	105	2.97	<10	120	0.17
97 KKA 5640	<0.2	2.67	<2	60	0.5	<2	0.5	<0.5	13	40	71	2.86	<10	80	0.22
97 KKA 5640 dup	<0.2	2.7	2	60	0.5	<2	0.5	<0.5	13	41	72	2.88	<10	60	0.23
97 KKA 5657	<0.2	3.57	6	90	0.5	<2	0.3	<0.5	27	66	65	4.22	10	80	0.32
97 KKA 5657 dup	<0.2	3.61	10	90	0.5	<2	0.3	<0.5	27	66	63	4.18	10	80	0.32

Standard ICP-AES (TCA 8010)

Sample	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppb	K %
Detection limit	0.2	0.01	2	10	0.5	2	0.01	0.5	1	1	1	0.01	10	1	0.01
min	<0.2	<0.01	<2	<10	<0.5	<2	<0.01	<0.5	<1	<1	<1	<0.01	0	0	<0.01
mean	<0.2	0.68	1.7	21	0	0	0.32	0	4.6	19	23	1.18	0	0	0.03
max	<0.2	1.02	6	30	0	0	0.5	0	7	28	34	1.78	<10	<1	0.05
Lab standard	<0.2	0.91	6	30	<.5	<2	0.4	<0.5	7	23	28	1.58	<10	40	0.05
Lab standard	<0.2	0.91	4	30	<.5	<2	0.4	<0.5	8	23	29	1.59	<10	30	0.05

Appendix D: Standards and duplicates for ICP-AES analyses (<0.002 mm)

Sample	La ppm	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	Pb ppm	Sb ppm	Sc ppm	Sr ppm	Ti %	U ppm	V ppm	Zn ppm
Detection limit	10	0.01	5	1	0.01	1	2	2	1	1	0.01	10	1	2
97 KKA 5545	80	1.7	335	1	1.3	70	14	<2	9	47	0.13	<10	87	108
97 KKA 5545 dup	90	1.8	345	1	1.3	76	16	<2	9	54	0.14	10	92	108
97 KKA 5559	50	2.3	565	<1	0.7	69	16	<2	11	41	0.22	<10	96	126
97 KKA 5559 dup	50	2.2	525	<1	0.6	68	12	<2	10	38	0.2	<10	93	120
97 KKA 5578	30	0.7	250	3	0.6	21	12	<2	4	17	0.1	<10	79	46
97 KKA 5578 dup	40	0.7	270	1	0.7	24	16	<2	4	16	0.1	10	86	52
97 KKA 5589B	40	1.5	390	<1	0.9	35	14	<2	6	77	0.11	<10	66	94
97 KKA 5589B dup	50	1.5	370	<1	0.9	33	14	<2	6	70	0.11	<10	64	92
97 KKA 5603	30	0.5	235	<1	0.7	18	8	<2	3	42	0.06	<10	52	30
97 KKA 5603 dup	30	0.4	205	<1	0.5	16	8	2	2	26	0.05	<10	45	26
97 KKA 5619	40	0.7	225	1	1.3	33	10	<2	4	27	0.11	<10	50	58
97 KKA 5619 dup	40	0.7	205	<1	1.2	31	10	<2	4	20	0.1	<10	46	56
97 KKA 5640	40	0.7	240	1	0.9	26	6	<2	4	38	0.1	<10	49	46
97 KKA 5640 dup	40	0.8	240	<1	0.9	26	6	<2	5	36	0.1	<10	49	46
97 KKA 5657	70	0.9	380	3	1.5	34	14	<2	6	29	0.11	<10	76	62
97 KKA 5657 dup	70	0.9	385	3	1.5	33	12	<2	6	28	0.11	<10	75	60

Sample	La ppm	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	Pb ppm	Sb ppm	Sc ppm	Sr ppm	Ti %	U ppm	V ppm	Zn ppm
Detection limit	10	0.01	5	1	0.01	1	2	2	1	1	0.01	10	1	2
min	<10	<0.01	<5	<1	<0.01	<1	<2	<2	<1	<1	<0.01	<10	<1	<2
mean	7.1	0.30	156	0	0.01	10.7	1.4	0.3	3.5	14.6	0.06	0	21	20
max	20	0.4	235	0	0	17	4	2	6	29	0.09	0	31	32
Lab standard	20	0.4	200	<1	<.01	15	<2	<2	5	25	0.08	<10	27	26
Lab standard	20	0.4	205	<1	<.01	16	4	<2	5	20	0.08	<10	27	28

Appendix E: Standards and duplicates for INAA analyses (<0.063 mm)

Sample	Au ppb	Ag ppm	As ppm	Ba ppm	Br ppm	Ca %	Co ppm	Cr ppm	Cs ppm	Fe %	Hf ppm	Hg ppm	Ir ppm	Mo ppm
Detection limit	2	5	0.5	50	0.5	1	1	5	1	0.01	1	1	5	1
97 KKA 5545	<2	<5	1.7	620	7.4	2	11	62	1	2.82	10	<1	<5	<1
97 KKA 5545 dup	3	<5	2	620	8.6	2	12	63	<1	2.79	10	<1	<5	<1
97 KKA 5558	3	<5	2	690	1.3	2	7	52	<1	2.16	12	<1	<5	<1
97 KKA 5558 dup	<2	<5	<0.5	640	2	1	8	49	<1	2.03	10	<1	<5	<1
97 KKA 5573	<2	<5	4	490	6.1	2	11	46	<1	2.49	10	<1	<5	2
97 KKA 5573 dup	4	<5	3.5	520	6.6	2	12	44	<1	2.59	9	<1	<5	4
97 KKA 5589B	5	<5	3	580	11	3	8	46	1	2.25	9	<1	<5	3
97 KKA 5589B dup	4	<5	1.7	500	10	<1	7	48	1	2.27	8	<1	<5	2
97 KKA 5600B	<2	<5	5.9	730	5.8	2	11	66	2	2.67	9	<1	<5	3
97 KKA 5600B dup	3	<5	5	560	5.3	3	11	62	2	2.6	9	<1	<5	6
97 KKA 5618	2	<5	2.7	530	3.4	2	10	49	1	2.39	10	<1	<5	<1
97 KKA 5618 dup	<2	<5	1.6	570	3.2	2	9	52	1	2.36	10	<1	<5	4
97 KKA 5640	4	5	<0.5	610	5	2	7	44	<1	2.19	10	<1	<5	<1
97 KKA 5640 dup	4	<5	2	650	5.2	3	7	47	<1	2.26	11	<1	<5	<1
97 KKA 5661	<2	<5	<0.5	640	3.7	2	8	48	<1	2.16	10	<1	<5	<1
97 KKA 5661 dup	3	<5	1.6	640	3.8	2	8	50	<1	2.23	10	<1	<5	<1
Standard (TCA 8010)														
min	155	<5	5	480	<0.5	<1	8	49	<1	2.15	8	<1	<5	<1
mean	236	23	6	583	2.2	2	9	61	1	2.41	8	<1	3	<1
max	411	25	8.7	710	3.2	3	10	64	1	2.74	9	<1	<5	6
Lab Standard	167	<5	6.7	550	2	2	10	60	1	2.22	7	<1	<5	<1
Lab Standard	164	<5	6.7	530	2	2	10	57	<1	2.29	8	<1	<5	<1
min, mean, max based on 7 samples														

Appendix E: Standards and duplicates for INAA analyses (<0.063 mm)

Sample	Na %	Ni ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn %	Sr %	Ta ppm	Th ppm	U ppm	W ppm	Zn ppm	La ppm
Detection limit	0.01	20	5	0.1	0.1	3	0.01	0.05	0.5	0.2	0.5	1	50	0.5
97 KKA 5545	2.08	100	78	<0.1	9.9	<3	<0.01	0.08	<0.5	11	3.2	<1	<50	45
97 KKA 5545 dup	2.08	<20	48	<0.1	10	<3	<0.01	<0.05	<0.5	12	3.6	<1	117	45
97 KKA 5558	2.05	58	50	0.2	8.8	<3	<0.01	<0.05	<0.5	8.8	1.6	<1	<50	27
97 KKA 5558 dup	1.96	<20	59	<0.1	8.2	<3	<0.01	<0.05	<0.5	8.2	1.3	<1	72	26
97 KKA 5573	2.13	<20	41	<0.1	9.1	<3	<0.01	<0.05	0.8	6.6	1.6	<1	<50	25
97 KKA 5573 dup	2.2	77	49	<0.1	9.2	4	<0.01	<0.05	<0.5	7	2	<1	67	25
97 KKA 5589B	2.3	63	90	<0.1	8.8	<3	<0.01	<0.05	0.7	13	2.5	<1	69	34
97 KKA 5589B dup	2.28	<20	71	<0.1	8.6	<3	<0.01	<0.05	1.2	13	2.4	<1	69	34
97 KKA 5600B	2.08	<20	79	<0.1	11	<3	<0.01	0.05	<0.5	12	2.7	<1	93	38
97 KKA 5600B dup	2.02	<20	95	<0.1	10	<3	<0.01	<0.05	1	11	2.3	<1	59	36
97 KKA 5618	2.3	<20	61	<0.1	9	<3	<0.01	<0.05	1.2	10	2.4	<1	86	35
97 KKA 5618 dup	2.23	70	68	0.2	8.9	<3	<0.01	<0.05	1.3	9.9	3	<1	76	35
97 KKA 5640	2.12	<20	37	<0.1	8.8	<3	<0.01	<0.05	<0.5	6.8	1.8	<1	66	24
97 KKA 5640 dup	2.2	<20	50	<0.1	9.1	<3	<0.01	<0.05	<0.5	7.4	2.3	<1	70	25
97 KKA 5661	1.98	61	49	<0.1	8.1	<3	<0.01	<0.05	<0.5	8.9	1.8	<1	57	28
97 KKA 5661 dup	2.12	<20	62	0.2	8.4	<3	<0.01	0.05	1	9.6	1.3	<1	<50	29
Standard (TCA 8010)														
min	2.11	<20	33	2.4	9.0	<3	<0.01	<0.05	0.3	5.0	<0.5	<1	25	24
mean	2.32	<20	49	3.0	10.5	<3	<0.01	<0.05	0.6	5.8	1.3	<1	61	28
max	2.41	<20	62	3.3	11.0	<3	<0.01	<0.05	1.7	6.0	1.9	<1	173	30
Lab Standard	2.12	<20	62	2.4	10	<3	<0.01	<0.05	<0.5	5.2	1.1	<1	84	26
Lab Standard	2.17	<20	57	2.6	11	<3	<0.01	<0.05	0.6	5.5	1	<1	79	27

Appendix E: Standards and duplicates for INAA analyses (<0.063 mm)

Sample	Ce ppm	Nd ppm	Sm ppm	Eu ppm	Tb ppm	Yb ppm	Lu ppm	Mass gm
Detection limit	3	5	0.1	0.2	0.5	0.2	0.05	
97 KKA 5545	82	34	5.4	1.3	<0.5	2	0.27	29.87
97 KKA 5545 dup	82	32	5.4	1.3	0.7	2	0.32	30.2
97 KKA 5558	55	24	4.1	1.2	0.6	2	0.29	33.14
97 KKA 5558 dup	50	19	3.9	1	<0.5	2	0.29	31.4
97 KKA 5573	51	22	3.7	1	<0.5	1.7	0.23	34.67
97 KKA 5573 dup	51	18	3.7	1.1	<0.5	1.8	0.23	33.21
97 KKA 5589B	73	27	5.7	1.3	<0.5	1.7	0.27	23.12
97 KKA 5589B dup	70	28	5.5	1.2	<0.5	1.6	0.25	23.93
97 KKA 5600B	75	28	5.5	1.3	<0.5	2.1	0.32	30.37
97 KKA 5600B dup	71	31	5.2	1.3	<0.5	2.1	0.31	28.59
97 KKA 5618	67	31	5.2	1.3	0.5	1.9	0.29	33.55
97 KKA 5618 dup	70	33	5.1	1.2	0.5	2	0.28	30.16
97 KKA 5640	48	18	3.8	1.1	<0.5	1.8	0.27	31.83
97 KKA 5640 dup	53	19	3.9	1.1	0.5	2	0.25	31.92
97 KKA 5661	55	23	4	1	<0.5	1.8	0.27	31.91
97 KKA 5661 dup	58	23	4	1	<0.5	1.9	0.28	31.36
Standard (TCA 8010)								
min	43	20	3.7	1.0	<0.5	1.8	0.26	---
mean	51	23	4.0	1.2	<0.5	2.0	0.29	---
max	53	25	4.3	1.3	0.6	2.0	0.32	---
Lab Standard	48	22	4.1	1.1	<0.5	2	0.27	34.41
Lab Standard	48	22	4.3	1.2	<0.5	2	0.28	32.78

Appendix F. Maps and histograms of element concentrations determined by ICP-AES (< 0.002 mm fraction)

List of elements depicted on maps and histograms:

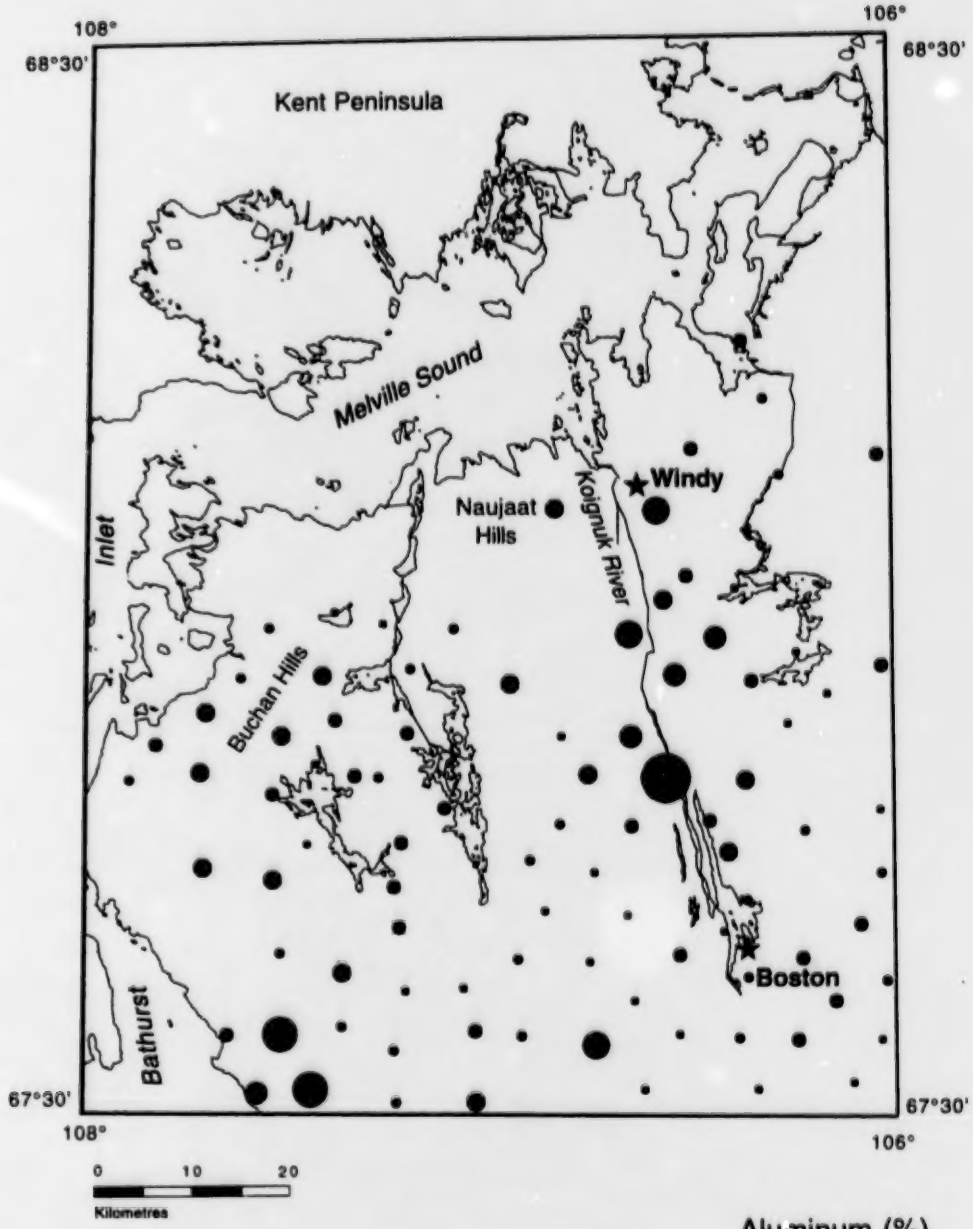
Al
Ba
Ca
Co
Cr
Cu
Fe
La
Mg
Mn
Ni
Pb
V
Zn

Abbreviations for Descriptive Statistics:

St. deviation = Standard deviation
Coeff. var = Coefficient of variation
Geom. mean = Geometric mean

NOTE: Range values on thematic dot maps range from (example):

30 to < 40
20 to < 30
10 to < 20
0 to < 10



Al

Rideout Island (760)

Aluminum (%)

Ranges	%tile	Count
5.25 - 5.29	100	(1)
4.92 - 5.25	99	(2)
4.69 - 4.92	97	(3)
4.43 - 4.69	95	(4)
3.96 - 4.43	90	(14)
3.57 - 3.96	75	(24)
2.94 - 3.57	50	(22)
< 2.94	25	(23)

Till geochemistry, Rideout Island NTS 76 O (N/2)

ALUMINUM

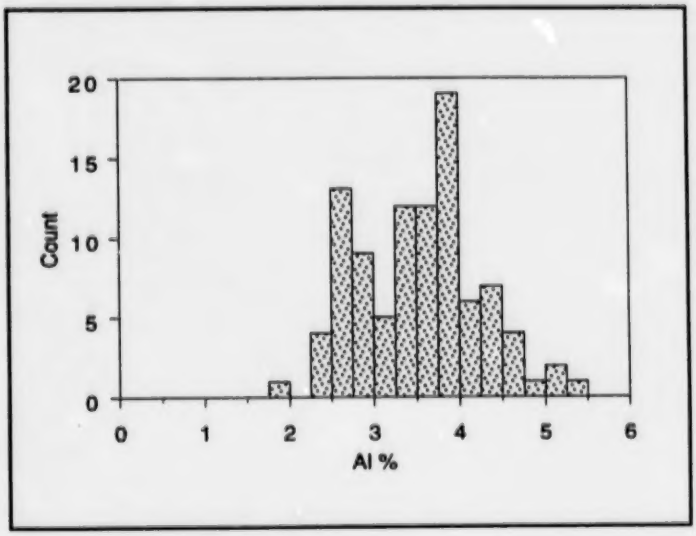
Al (%)

Fraction:	<0.002 mm	Detection limit:	0.01%
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

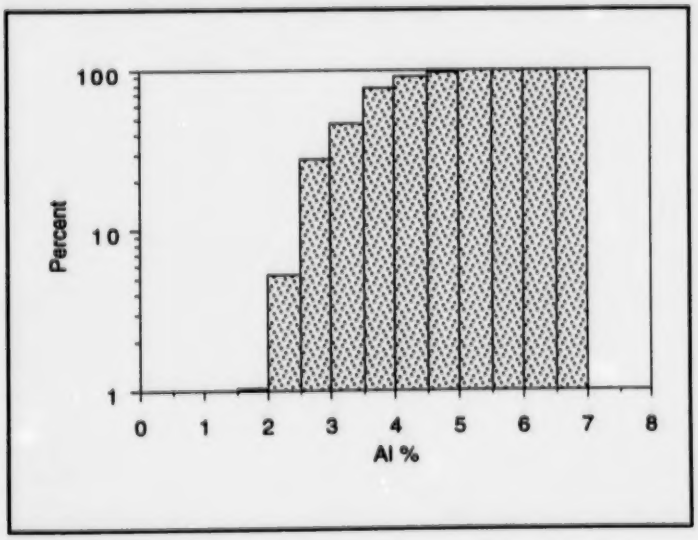
Descriptive Statistics

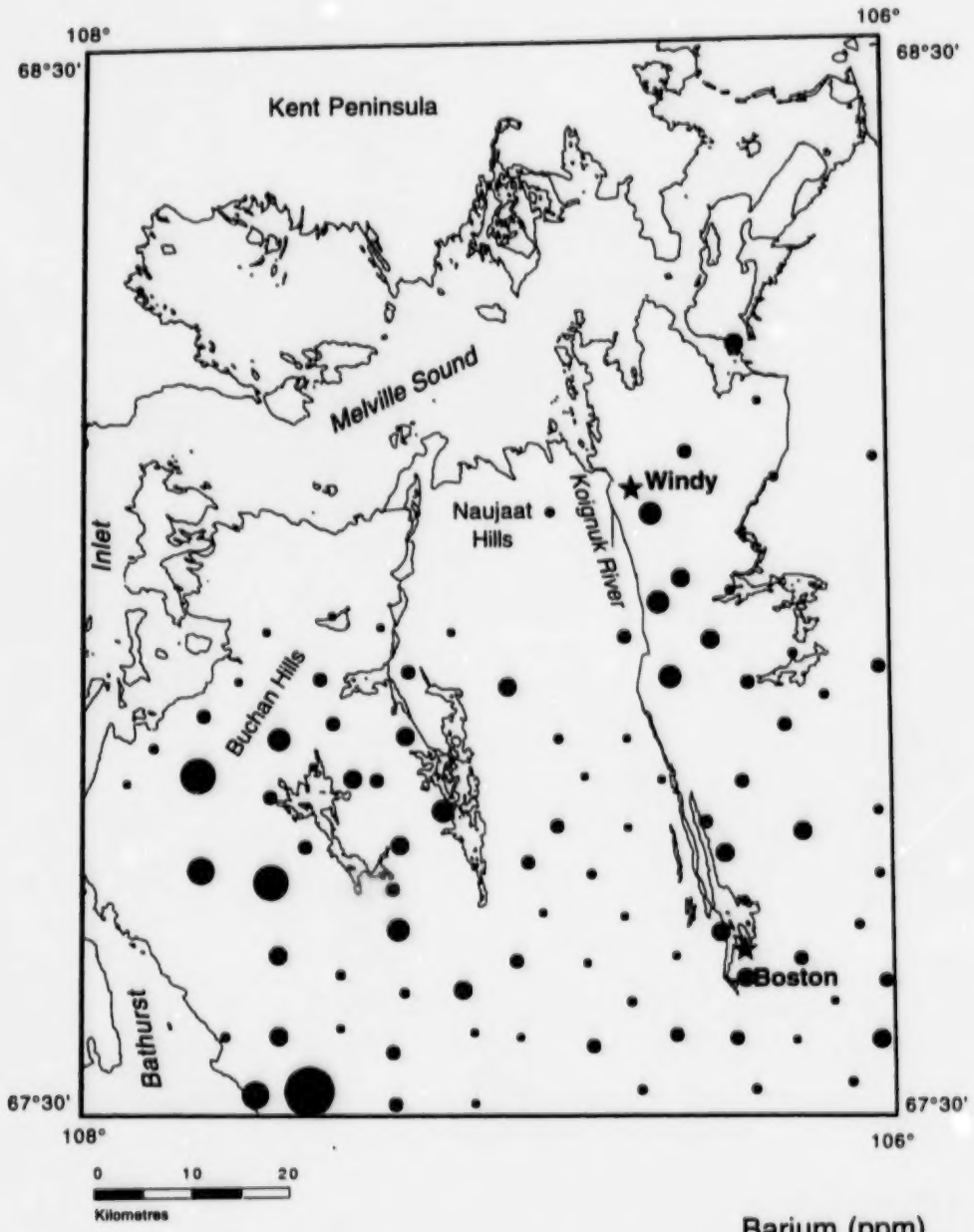
Count:	97
Minimum:	0.01
Maximum:	5.29
Mean:	3.48
Median:	3.57
Mode:	
St. deviation:	0.8
Coeff. var:	0.23
Geom. mean	3.25
Skewness:	-0.69
Kurtosis:	2.53

Frequency Histogram



Cumulative Plot





Ba

Rideout Island (760)

Barium (ppm)

Ranges	%tile	Count
265 - 270	100	(1)
236 - 265	99	(2)
217 - 236	97	(2)
200 - 217	95	(6)
160 - 200	90	(15)
100 - 160	75	(25)
80 - 100	50	(20)
< 80	25	(22)

Till geochemistry, Rideout Island NTS 76 O (N/2)

BARIUM

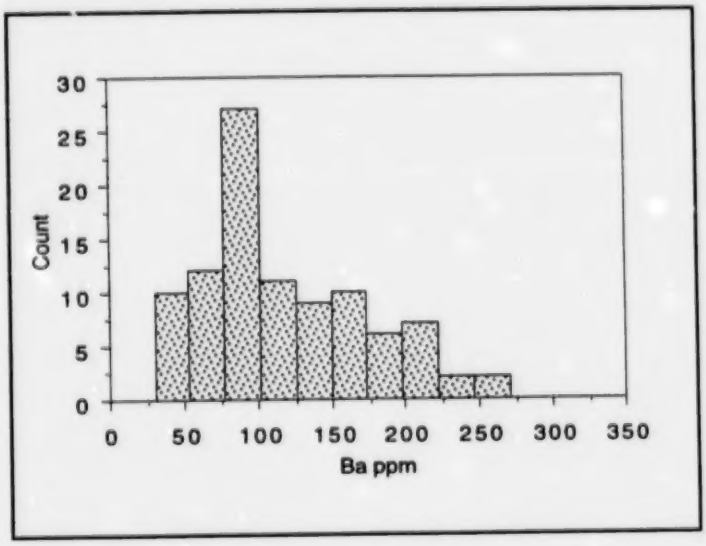
Ba (ppm)

Fraction:	<0.002 mm	Detection limit:	10 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

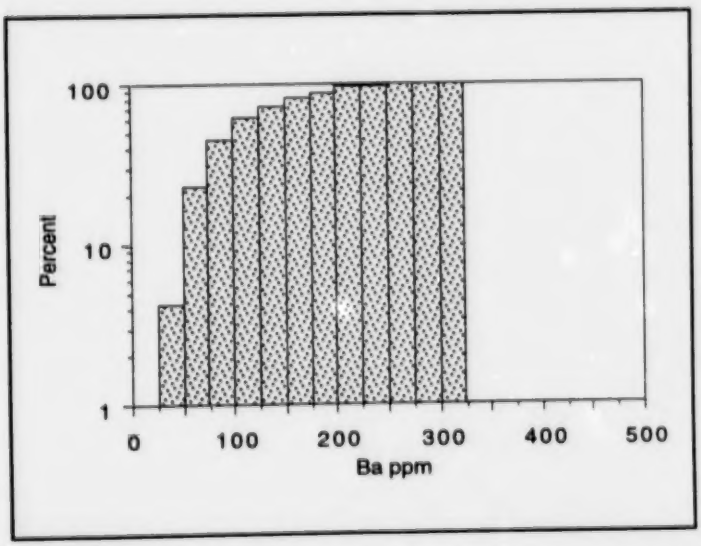
Descriptive Statistics

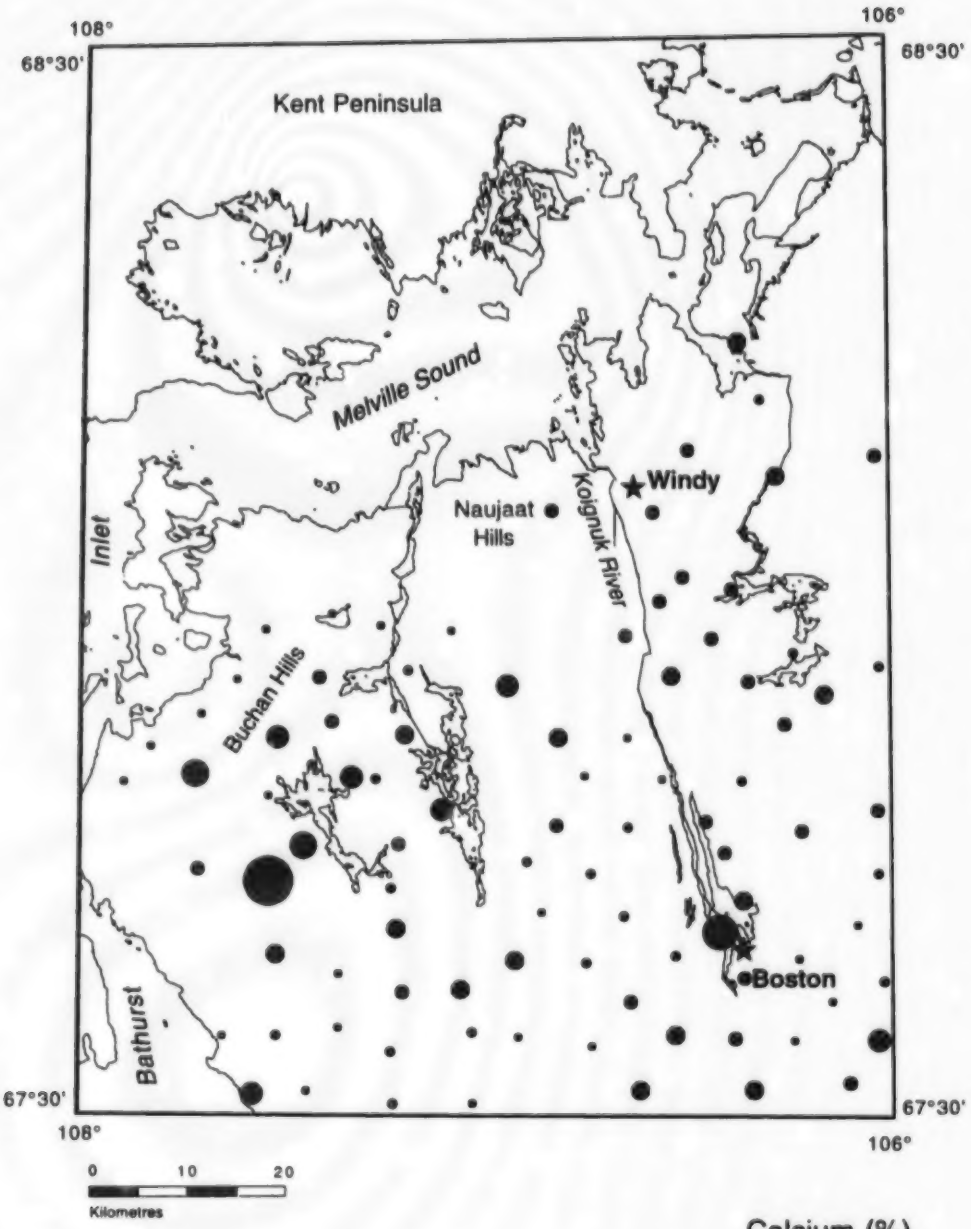
Count:	97
Minimum:	10
Maximum:	270
Mean:	116.08
Median:	100
Mode:	90
St. deviation:	55.93
Coeff. var:	0.48
Geom. mean	102.27
Skewness:	0.66
Kurtosis:	-0.24

Frequency Histogram



Cumulative Plot





Ca

Rideout Island (760)

Calcium (%)

Ranges	%tile	Count
1.69 - 1.85	100	(1)
0.98 - 1.69	99	(1)
0.88 - 0.98	97	(2)
0.83 - 0.88	95	(6)
0.66 - 0.83	90	(14)
0.49 - 0.66	75	(25)
0.35 - 0.49	50	(20)
< 0.35	25	(24)

Till geochemistry, Rideout Island NTS 76 O (N/2)

CALCIUM

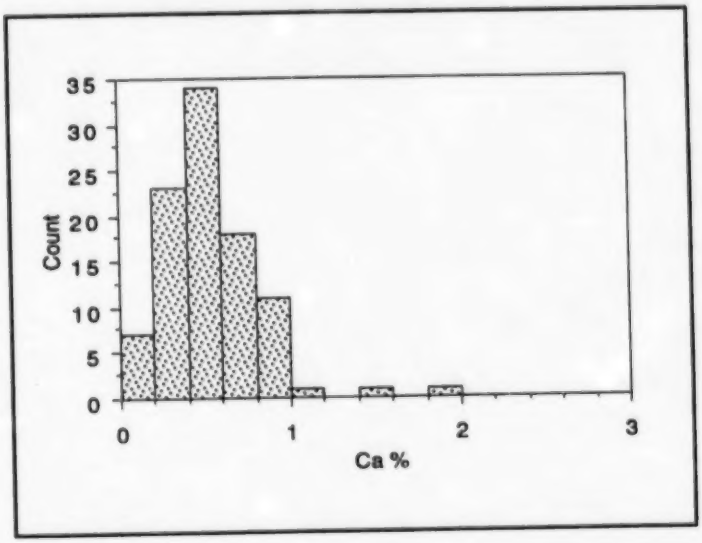
Ca (%)

Fraction:	<0.002 mm	Detection limit:	0.01%
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

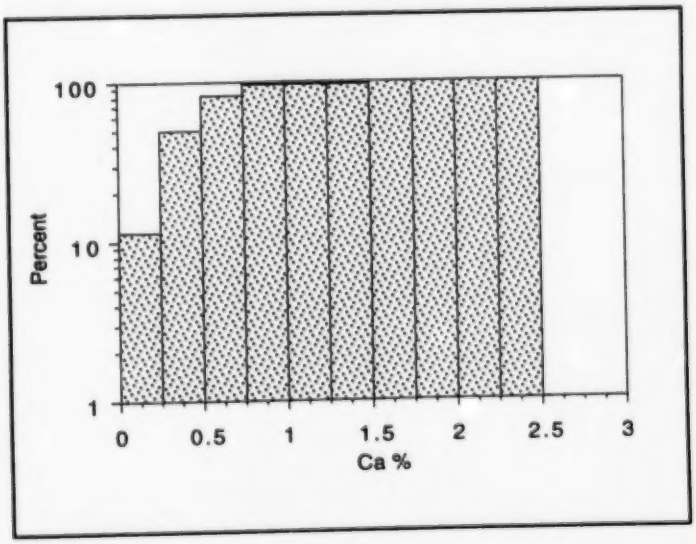
Descriptive Statistics

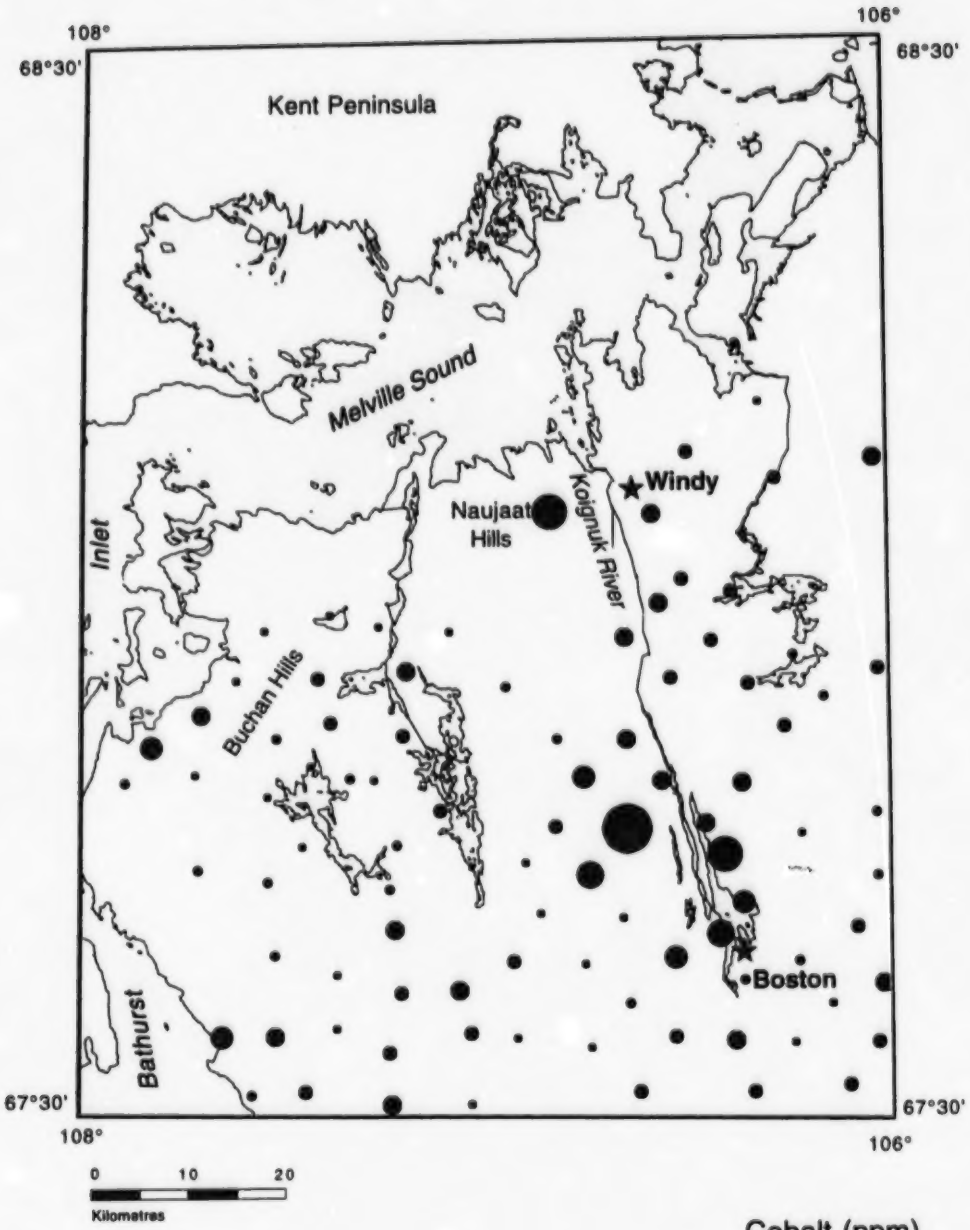
Count:	97
Minimum:	0.01
Maximum:	1.85
Mean:	0.52
Median:	0.49
Mode:	
St. deviation:	0.28
Coeff. var:	0.53
Geom. mean	0.44
Skewness:	1.57
Kurtosis:	5.36

Frequency Histogram



Cumulative Plot





Co

Rideout Island (760)

Cobalt (ppm)

Ranges	%tile	Count
54 - 55	100	(1)
53 - 54	99	(2)
50 - 53	97	(2)
41 - 50	95	(5)
28 - 41	90	(16)
23 - 28	75	(25)
20 - 23	50	(19)
< 20	25	(23)

Till geochemistry, Rideout Island NTS 76 O (N/2)

COBALT

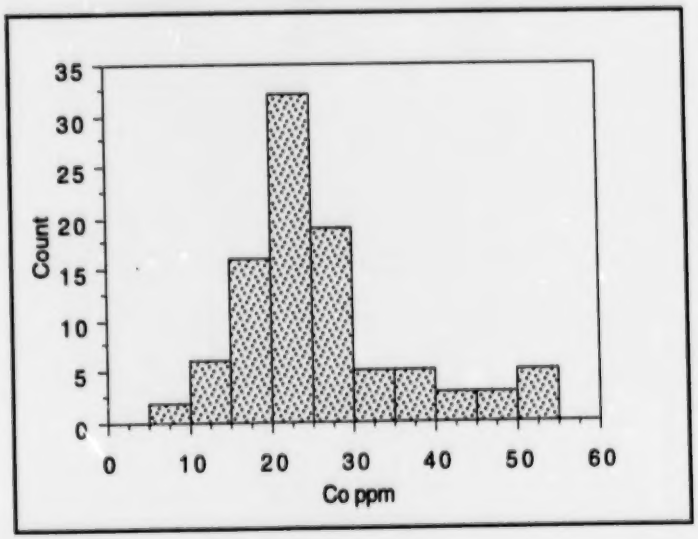
Co (ppm)

Fraction:	<0.002 mm	Detection limit:	1 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

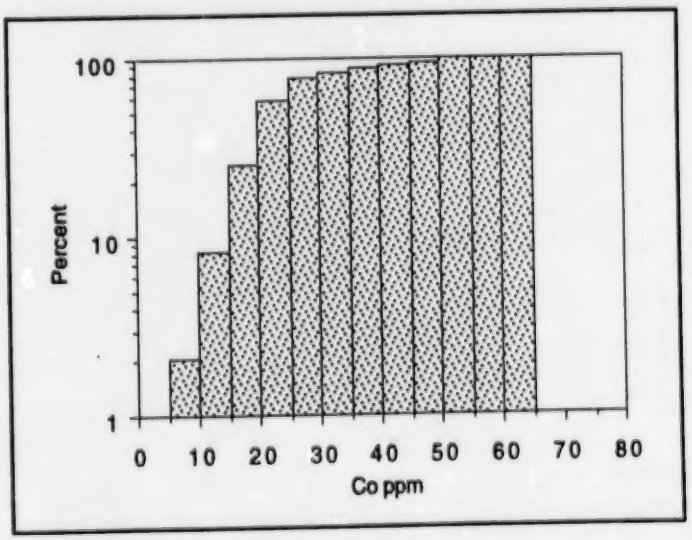
Descriptive Statistics

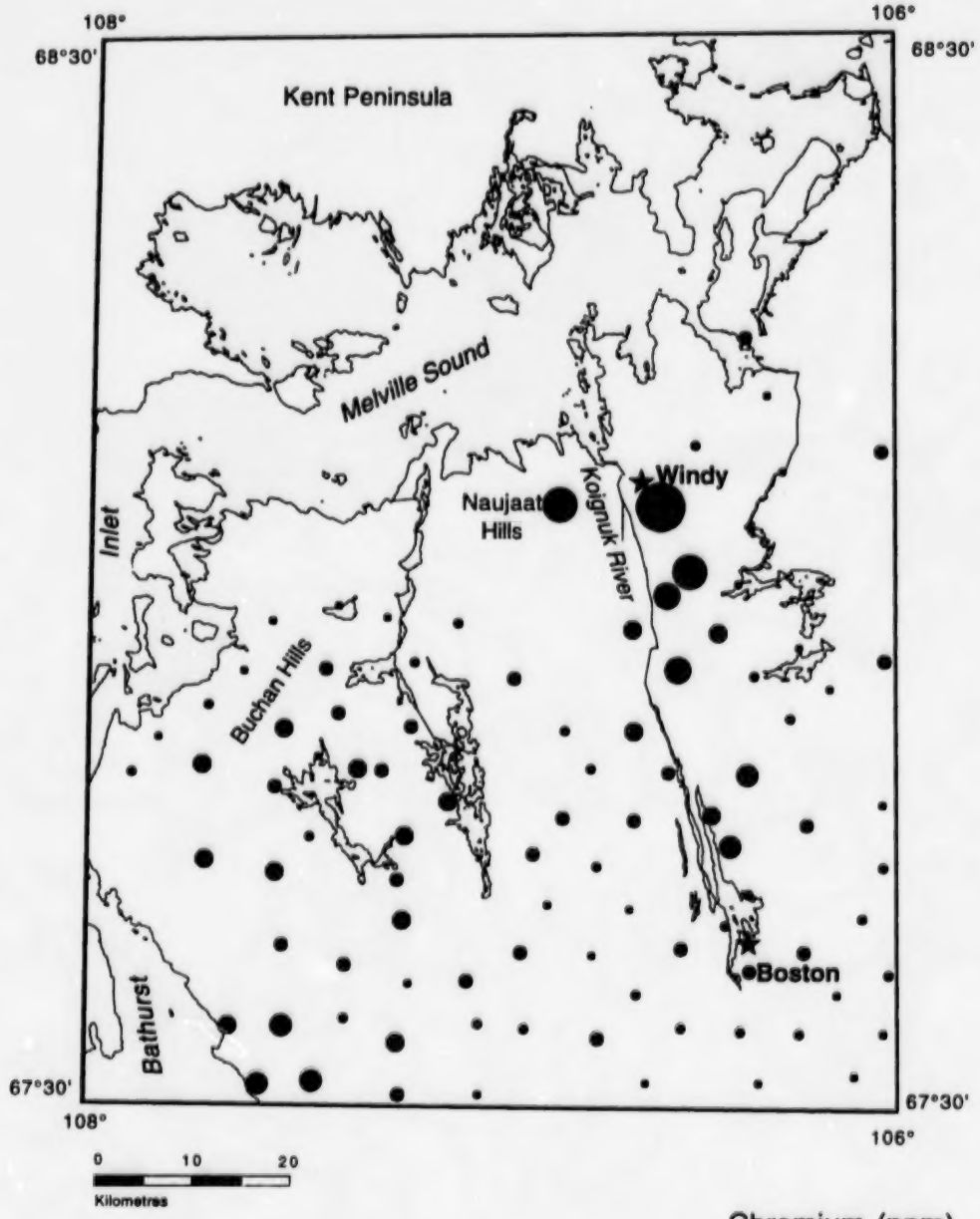
Count:	97
Minimum:	1
Maximum:	54
Mean:	25.15
Median:	23
Mode:	21
St. deviation:	10.56
Coeff. var:	0.42
Geom. mean	22.76
Skewness:	0.97
Kurtosis:	0.97

Frequency Histogram



Cumulative Plot





Cr

Rideout Island (760)

Chromium (ppm)

Ranges	%tile	Count
145 - 156	100	(1)
117 - 145	99	(2)
114 - 117	97	(2)
103 - 114	95	(5)
90 - 103	90	(14)
72 - 90	75	(24)
57 - 72	50	(23)
< 57	25	(22)

Till geochemistry, Rideout Island NTS 76 O (N/2)

CHROMIUM

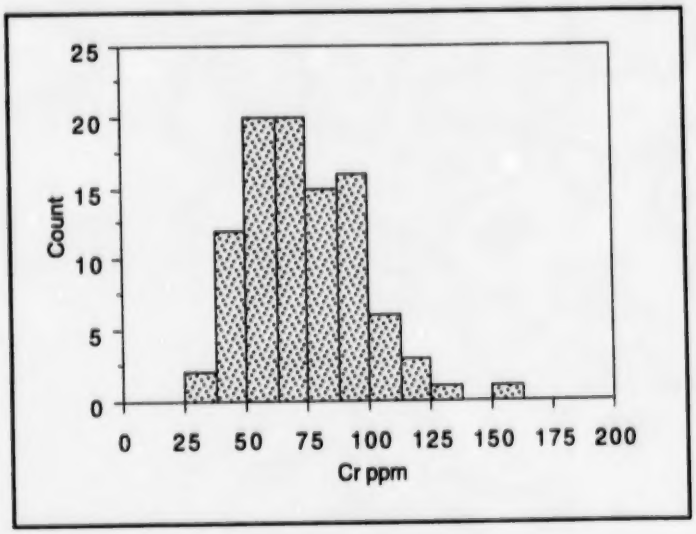
Cr (ppm)

Fraction:	<0.002 mm	Detection limit:	1 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

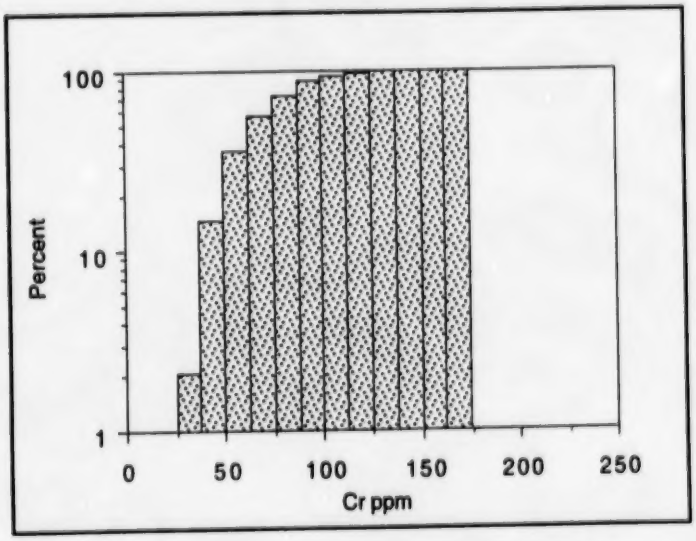
Descriptive Statistics

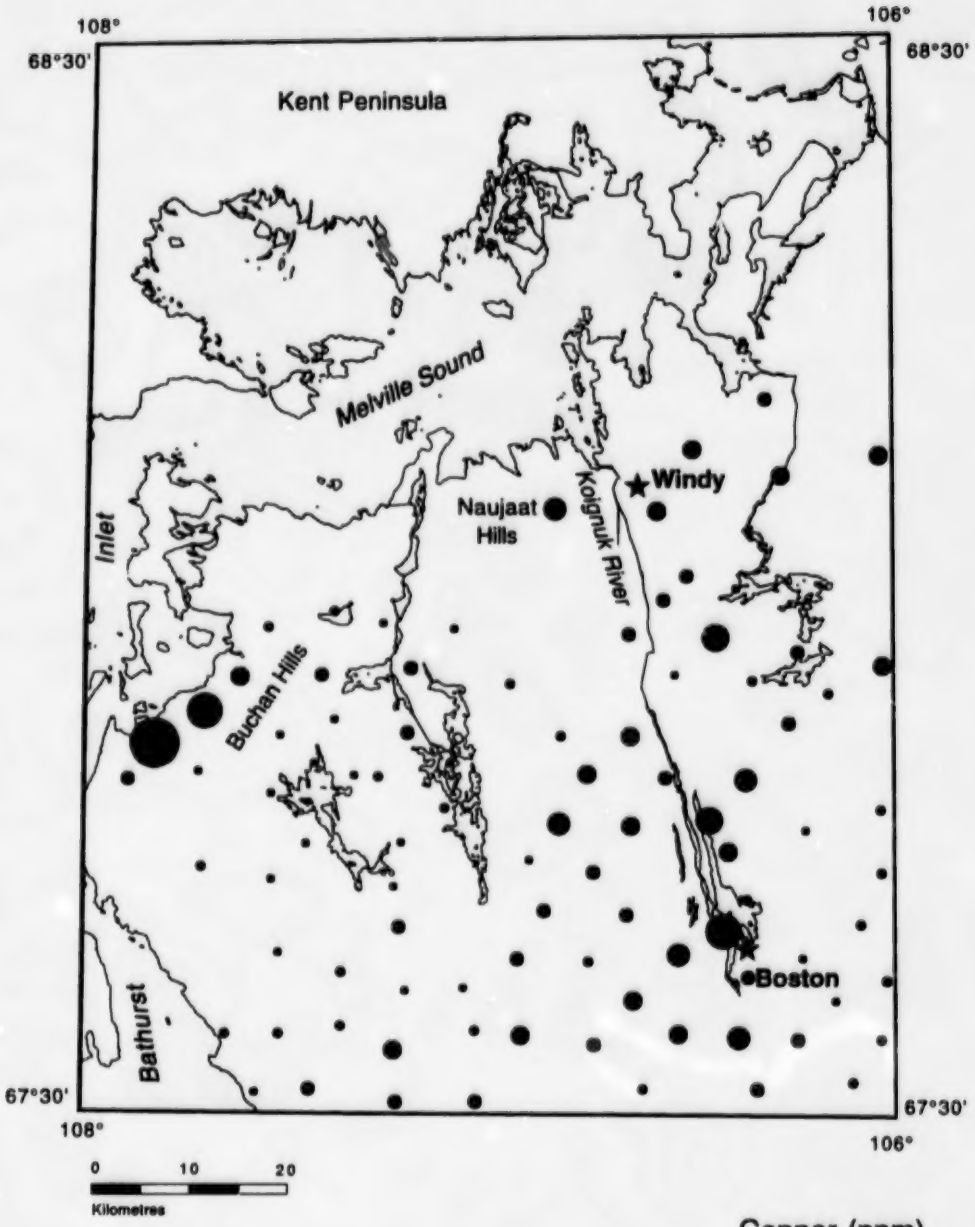
Count:	97
Minimum:	1
Maximum:	156
Mean:	72.62
Median:	72
Mode:	66
St. deviation:	23.97
Coeff. var:	0.33
Geom. mean	66.84
Skewness:	0.34
Kurtosis:	1.02

Frequency Histogram



Cumulative Plot





Cu

Rideout Island (760)

Copper (ppm)

Ranges	%tile	Count
381 - 416	100	(1)
302 - 381	99	(2)
250 - 302	97	(2)
193 - 250	95	(5)
141 - 193	90	(14)
94 - 141	75	(23)
64 - 94	50	(23)
< 64	25	(23)

Till geochemistry, Rideout Island NTS 76 O (N/2)

COPPER

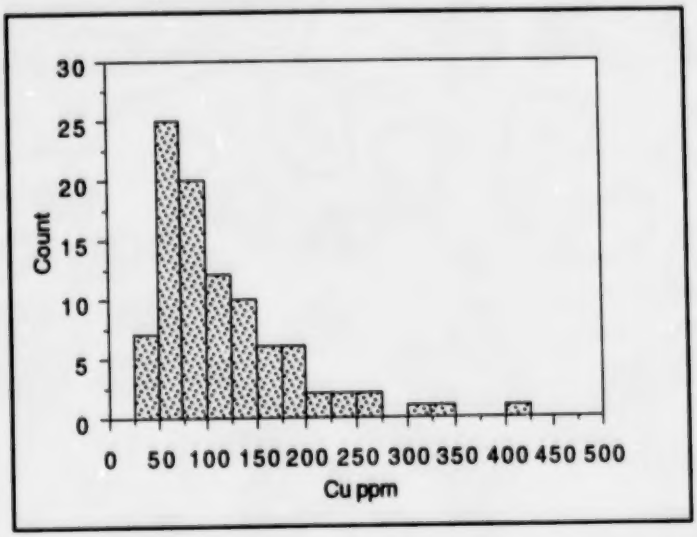
Cu (ppm)

Fraction:	<0.002 mm	Detection limit:	1 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

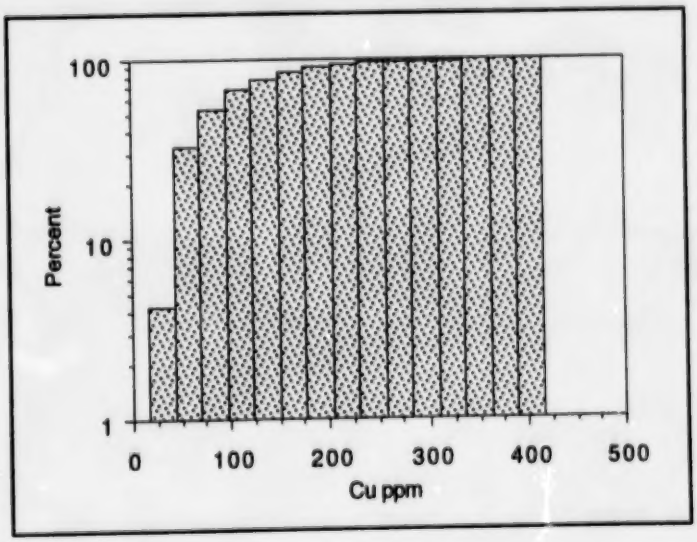
Descriptive Statistics

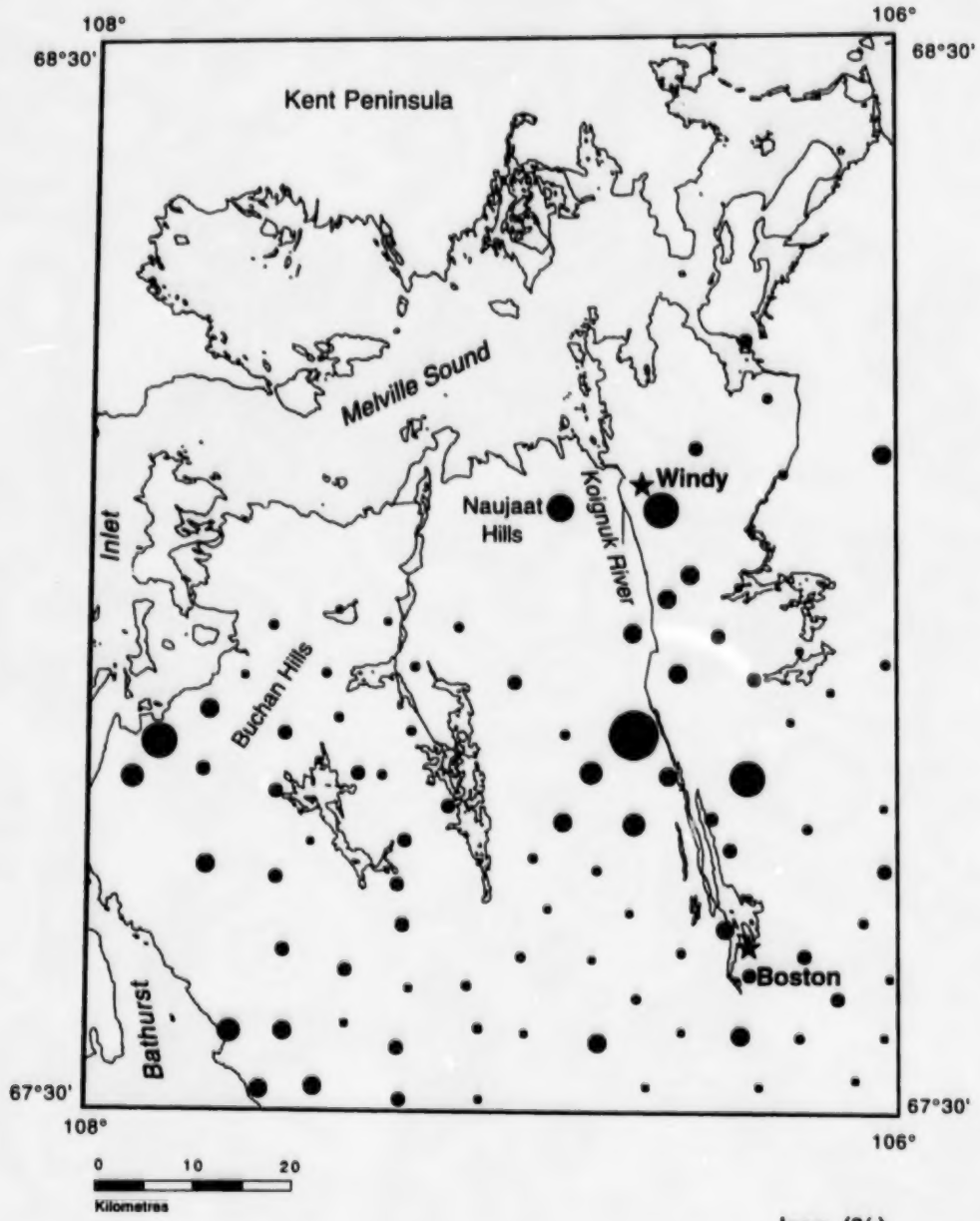
Count:	97
Minimum:	1
Maximum:	416
Mean:	112.01
Median:	94
Mode:	62
St. deviation:	70
Coeff. var:	0.62
Geom. mean	92.41
Skewness:	1.73
Kurtosis:	3.89

Frequency Histogram



Cumulative Plot





Fe

Rideout Island (760)

Iron (%)

Ranges	%tile	Count
6.6 - 6.84	100	(1)
6.2 - 6.6	99	(3)
6 - 6.2	97	(1)
5.6 - 6	95	(4)
5.1 - 5.6	90	(15)
4.4 - 5.1	75	(24)
3.8 - 4.4	50	(21)
< 3.8	25	(24)

Till geochemistry, Rideout Island NTS 76 O (N/2)

IRON

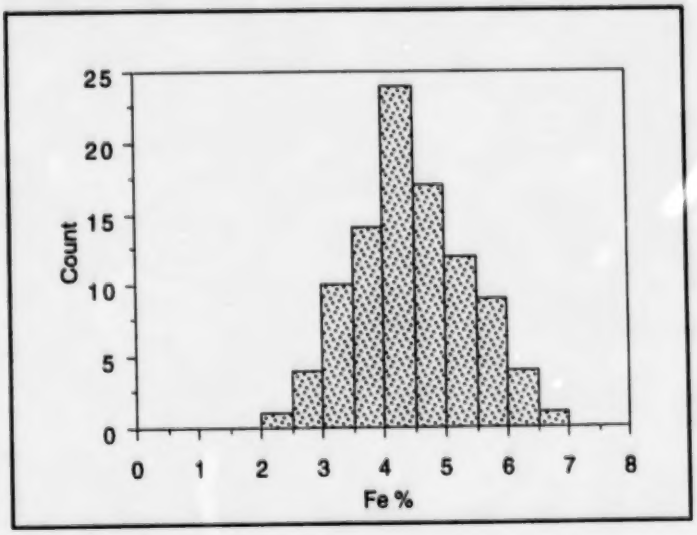
Fe (%)

Fraction:	<0.002 mm	Detection limit:	0.01%
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

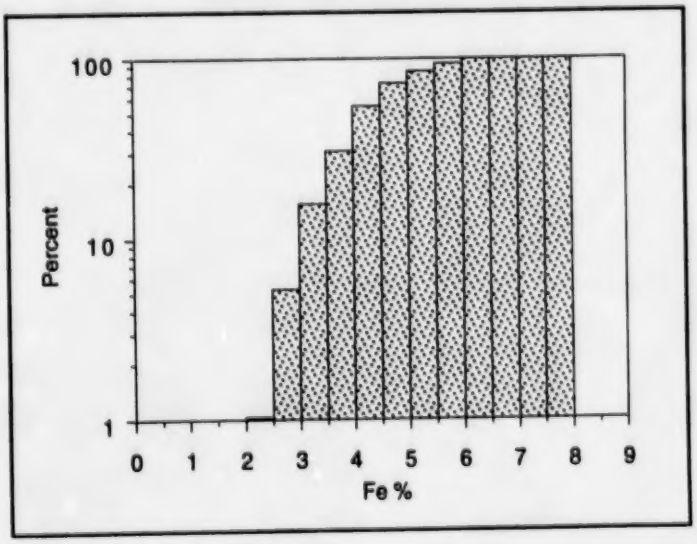
Descriptive Statistics

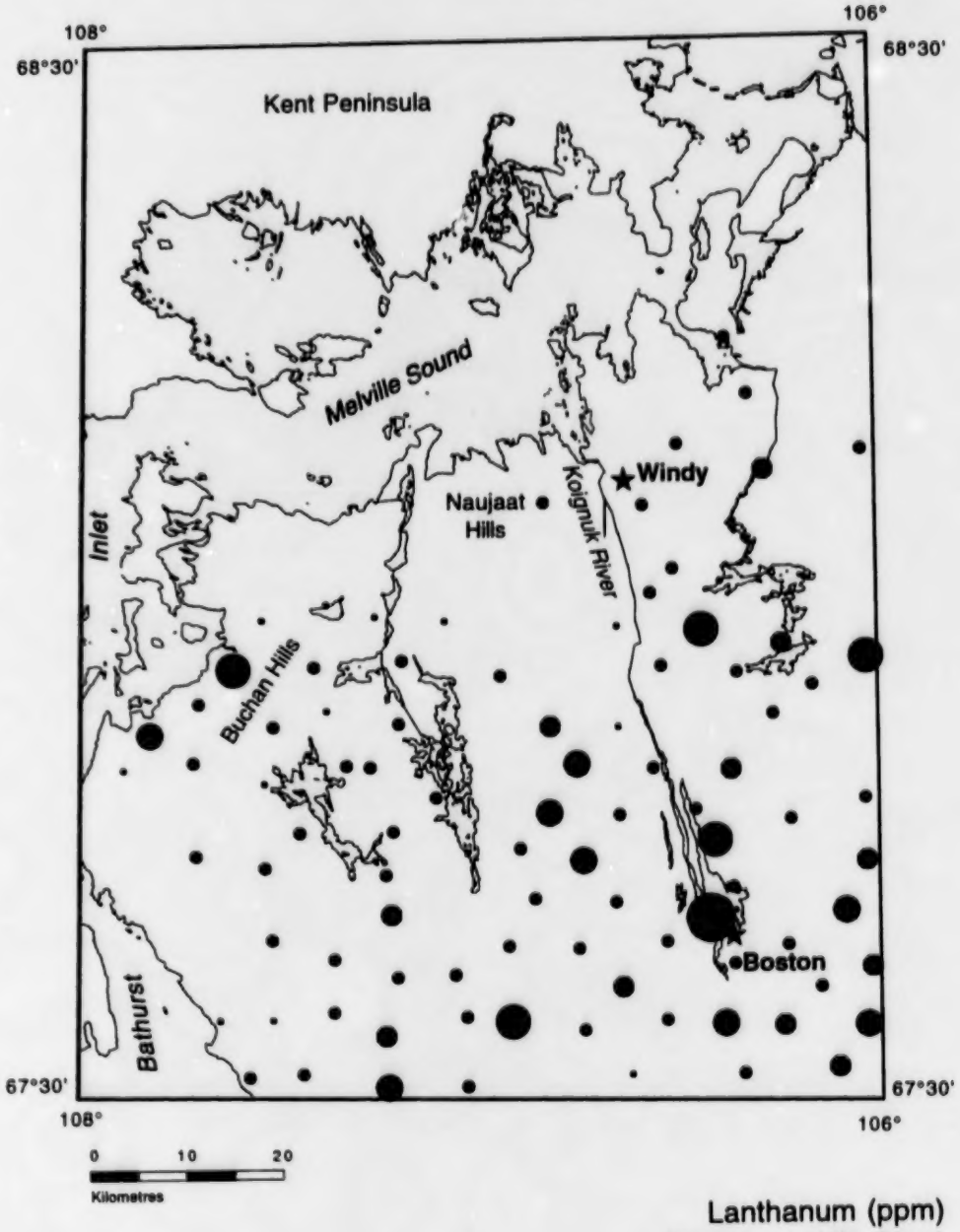
Count:	97
Minimum:	0.01
Maximum:	6.84
Mean:	4.38
Median:	4.4
Mode:	
St. deviation:	1.03
Coeff. var:	0.23
Geom. mean	4.07
Skewness:	-0.6
Kurtosis:	2.28

Frequency Histogram



Cumulative Plot





La

Rideout Island (760)

Lanthanum (ppm)

Ranges	%tile	Count
127 - 150	100	(1)
80 - 127	99	(5)
70 - 80	95	(8)
60 - 70	90	(11)
40 - 60	75	(54)
< 40	50	(14)

Till geochemistry, Rideout Island NTS 76 O (N/2)

LANTHANUM

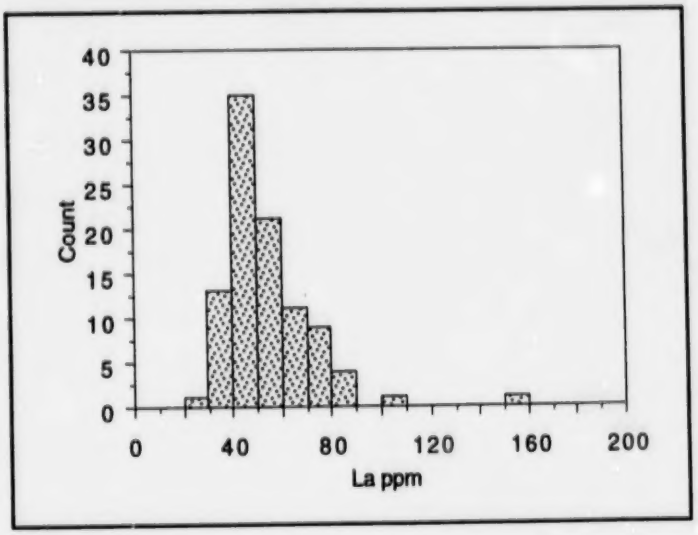
La (ppm)

Fraction:	<0.002 mm	Detection limit:	10 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

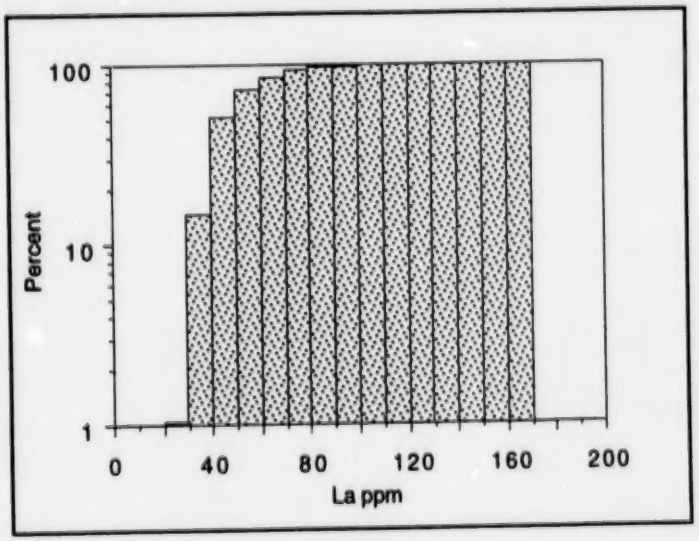
Descriptive Statistics

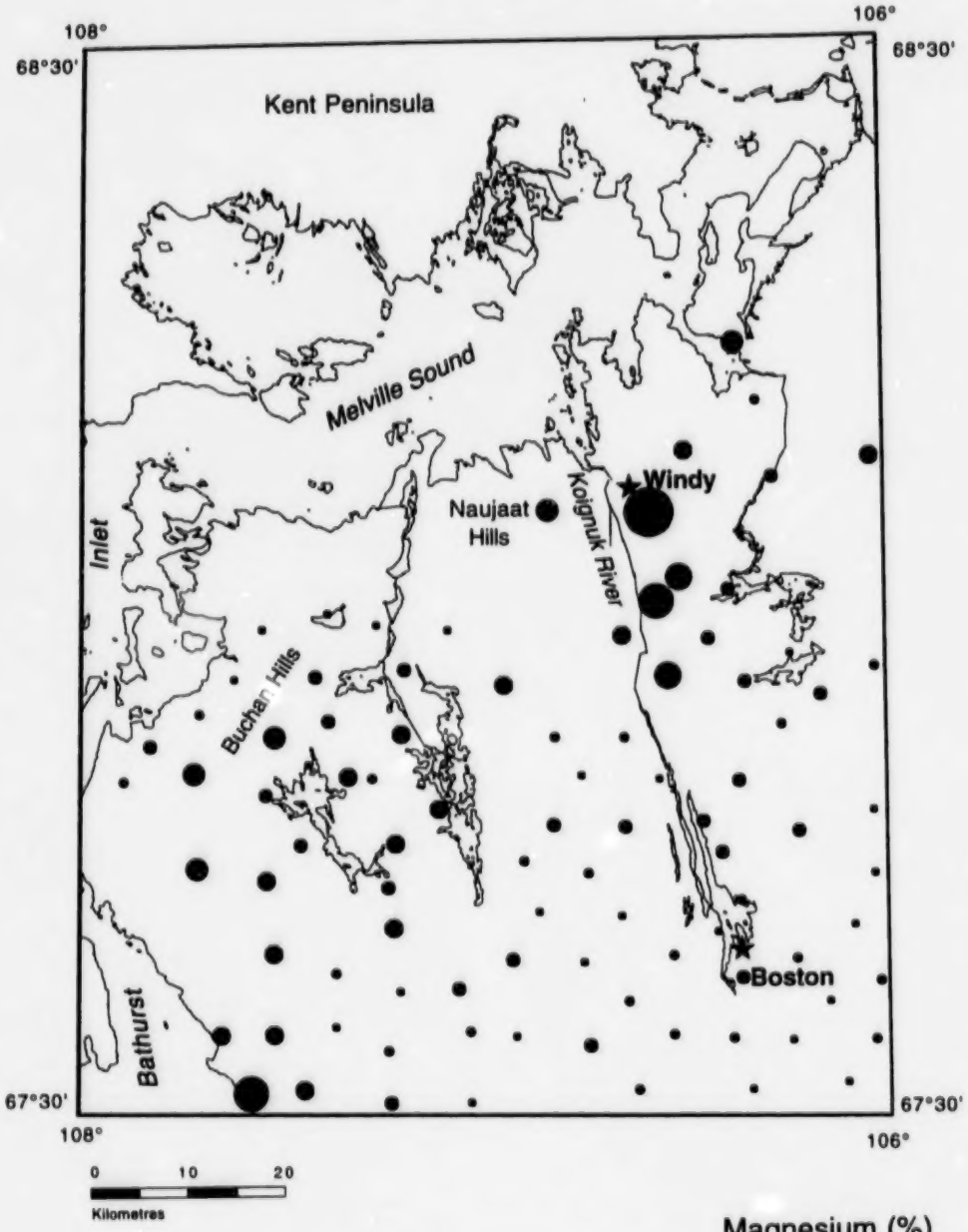
Count:	97
Minimum:	10
Maximum:	150
Mean:	48.76
Median:	40
Mode:	40
St. deviation:	18.22
Coeff. var:	0.37
Geom. mean	45.91
Skewness:	2.09
Kurtosis:	8.71

Frequency Histogram



Cumulative Plot





Mg

Rideout Island (760)

Magnesium (%)

Ranges	%tile	Count
2.39 - 2.44	100	(1)
2.27 - 2.39	99	(2)
2.21 - 2.27	97	(2)
2.06 - 2.21	95	(5)
1.75 - 2.06	90	(14)
1.38 - 1.75	75	(23)
0.95 - 1.38	50	(22)
< 0.95	25	(24)

Till geochemistry, Rideout Island NTS 76 O (N/2)

MAGNESIUM

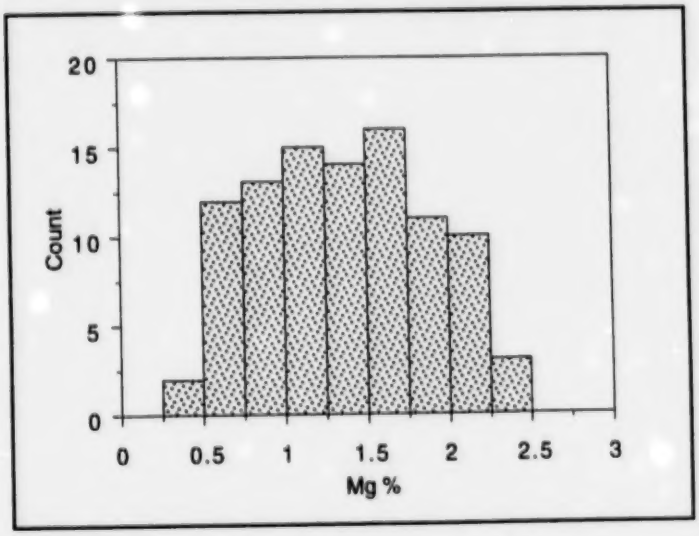
Mg (%)

Fraction:	<0.002 mm	Detection limit:	0.01%
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

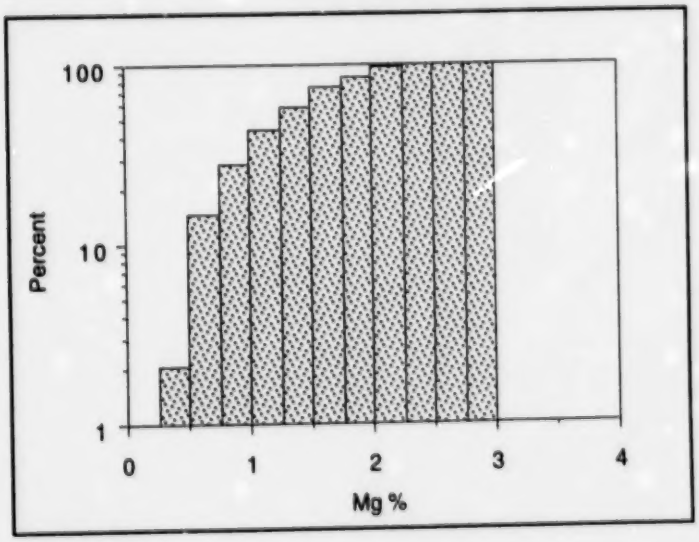
Descriptive Statistics

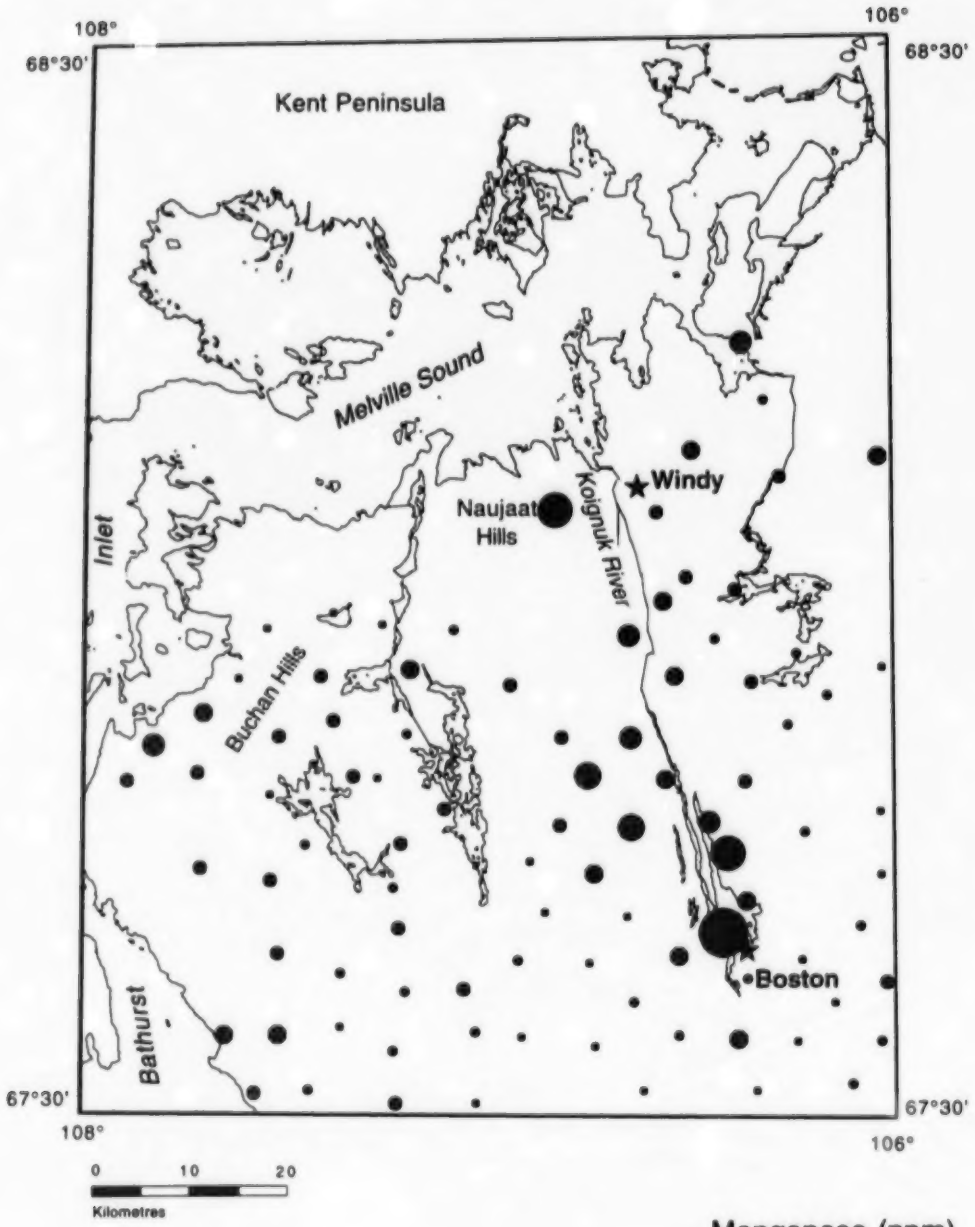
Count:	97
Minimum:	0.01
Maximum:	2.44
Mean:	1.35
Median:	1.38
Mode:	
St. deviation:	0.53
Coeff. var:	0.39
Geom. mean	1.2
Skewness:	-0.05
Kurtosis:	-0.69

Frequency Histogram



Cumulative Plot





Mn

Rideout Island (760)

Manganese (ppm)

Ranges	%tile	Count
1,551 - 1,940	100	(1)
1,001 - 1,551	99	(2)
900 - 1,001	97	(2)
668 - 900	95	(5)
513 - 668	90	(13)
425 - 513	75	(25)
330 - 425	50	(22)
< 330	25	(23)

Till geochemistry, Rideout Island NTS 76 O (N/2)

MANGANESE

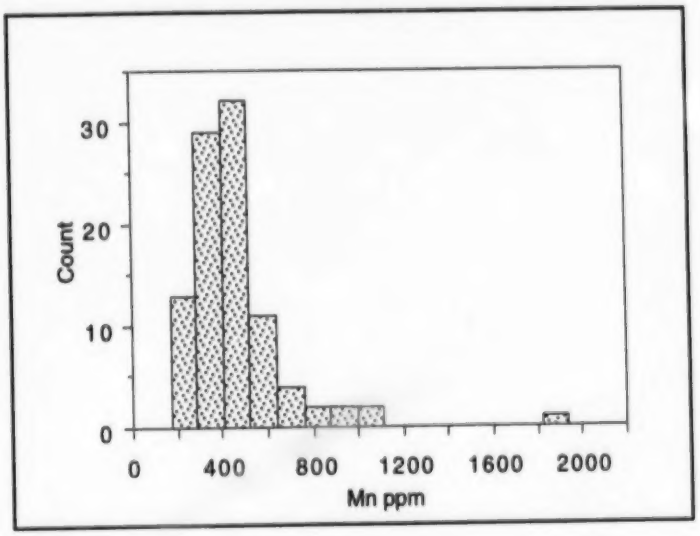
Mn (ppm)

Fraction:	<0.002 mm	Detection limit:	5 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

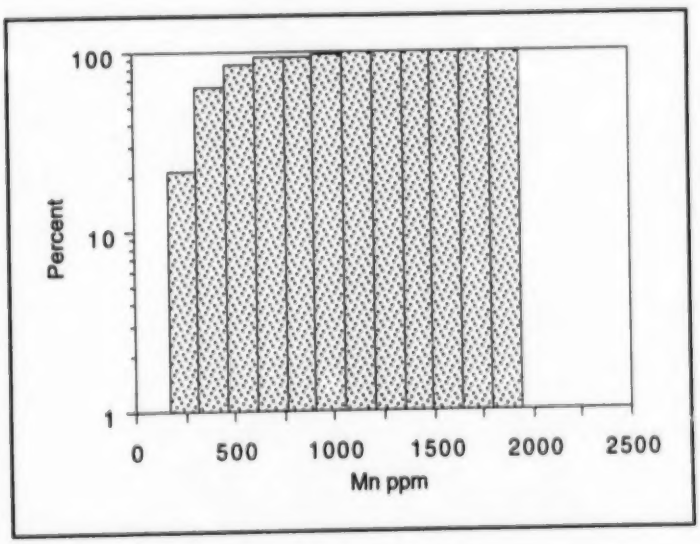
Descriptive Statistics

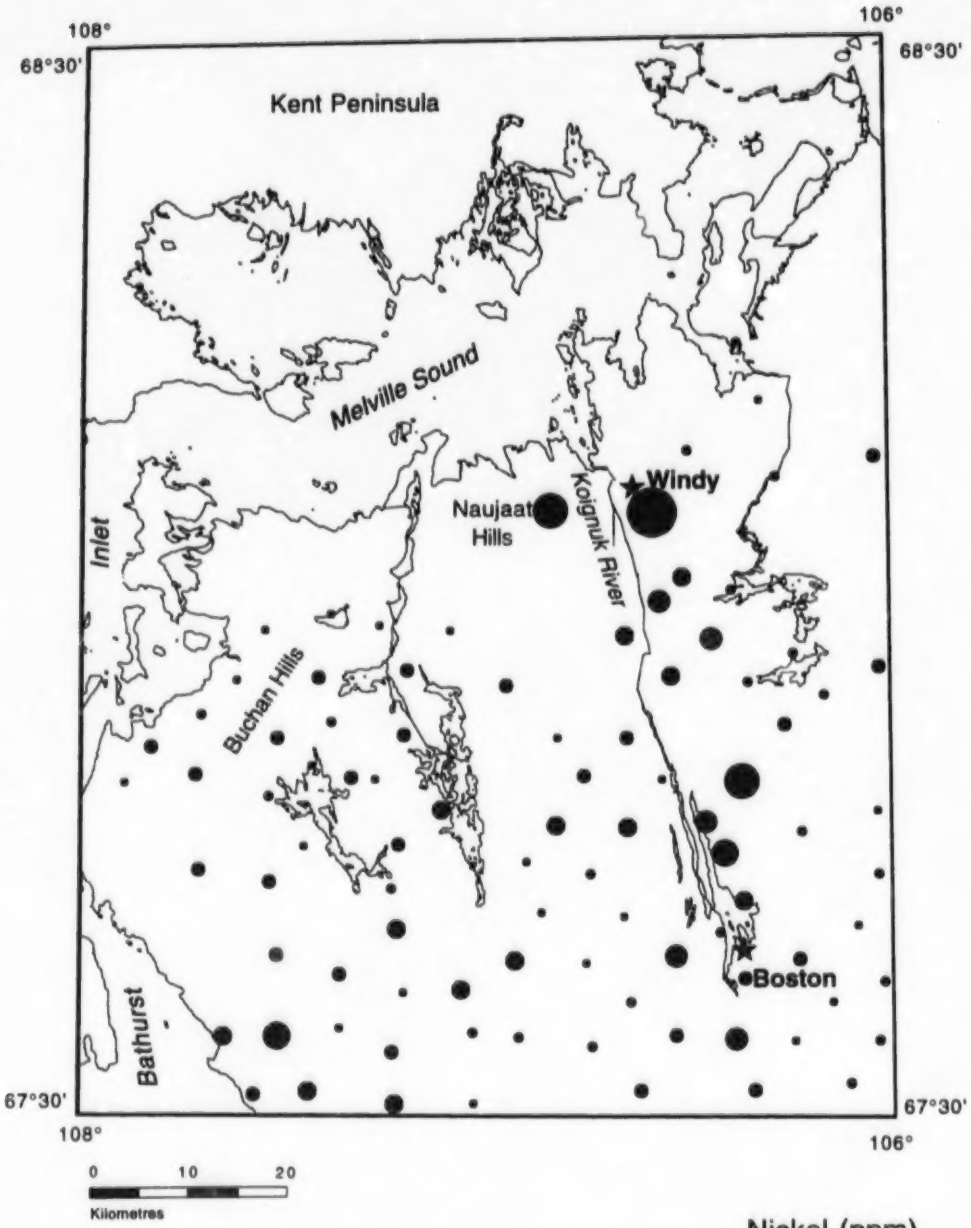
Count:	97
Minimum:	5
Maximum:	1940
Mean:	454.95
Median:	425
Mode:	
St. deviation:	238.95
Coeff. var:	0.53
Geom. mean	399.99
Skewness:	2.92
Kurtosis:	14.45

Frequency Histogram



Cumulative Plot





Ni

Rideout Island (760)

Nickel (ppm)

Ranges	%tile	Count
92 - 95	100	(1)
81 - 92	99	(2)
75 - 81	97	(2)
68 - 75	95	(5)
54 - 68	90	(13)
44 - 54	75	(25)
36 - 44	50	(22)
< 36	25	(23)

Till geochemistry, Rideout Island NTS 76 O (N/2)

NICKEL

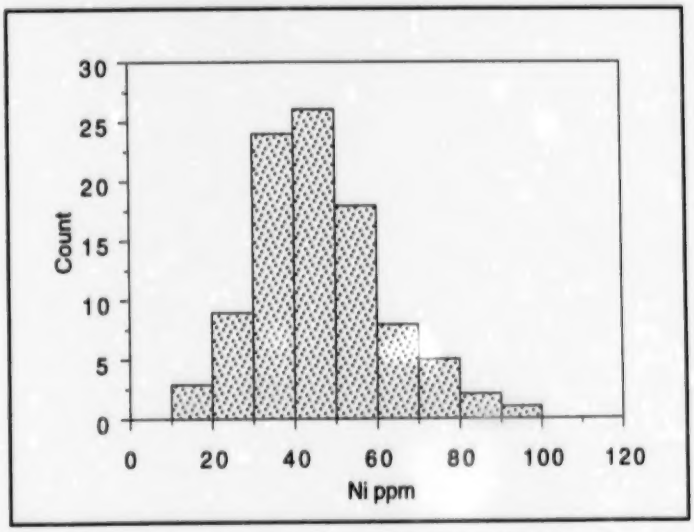
Ni (ppm)

Fraction:	<0.002 mm	Detection limit:	1 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

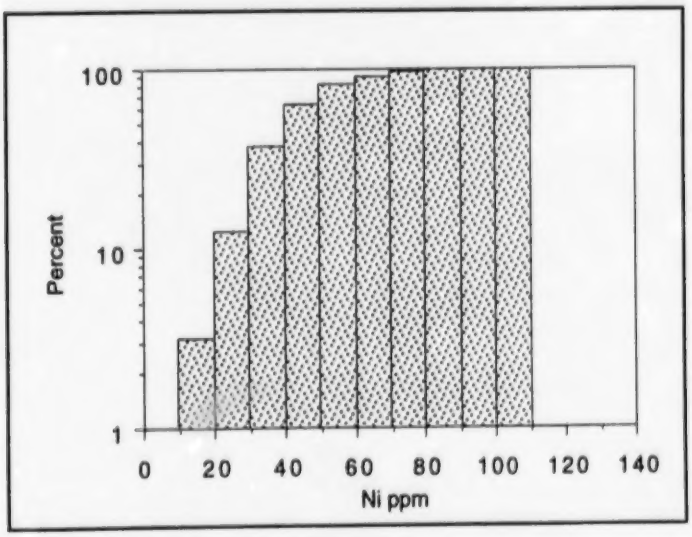
Descriptive Statistics

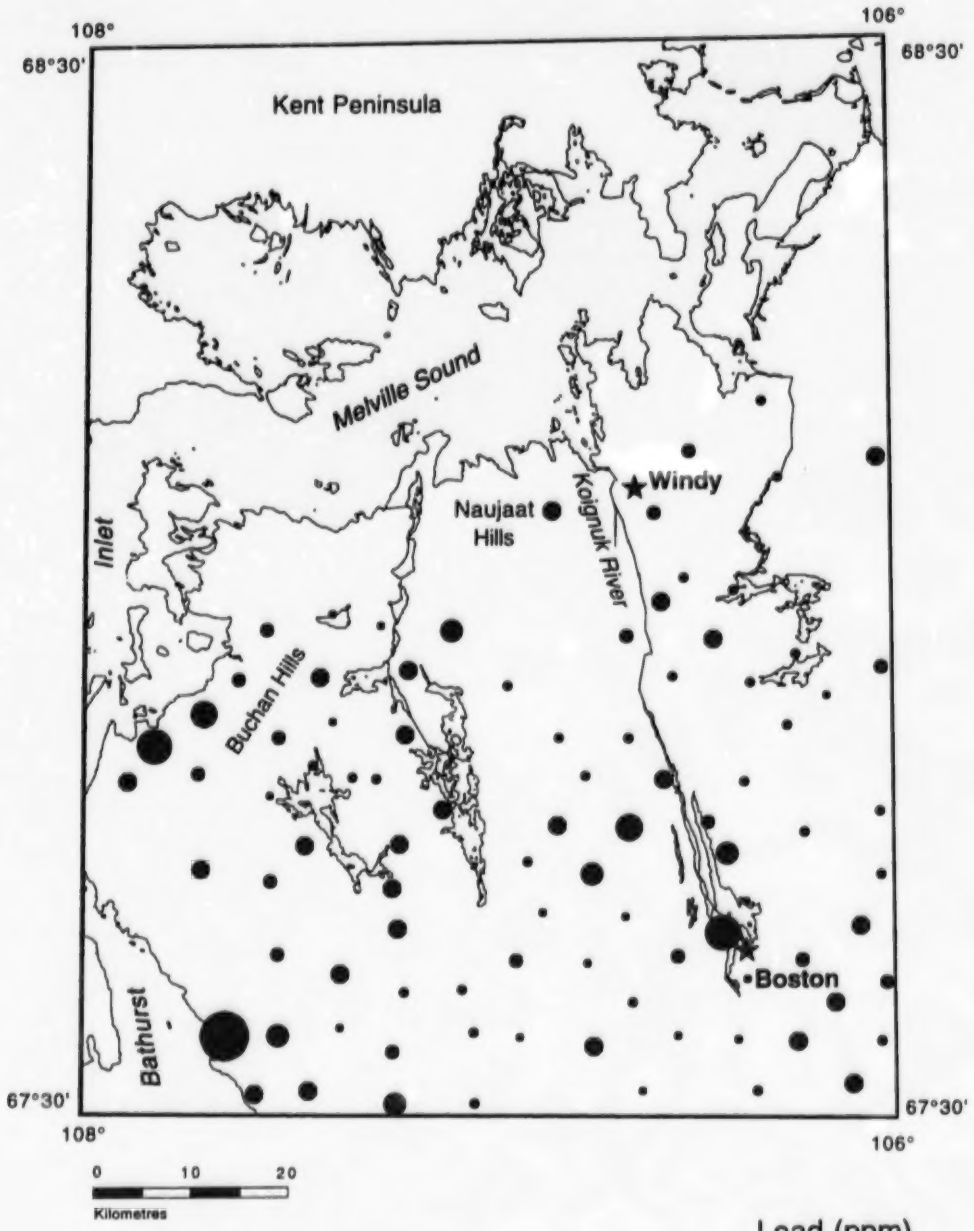
Count:	97
Minimum:	1
Maximum:	95
Mean:	45.15
Median:	44
Mode:	
St. deviation:	16.26
Coeff. var:	0.36
Geom. mean	41.23
Skewness:	0.42
Kurtosis:	0.76

Frequency Histogram



Cumulative Plot





Pb

Rideout Island (760)

Lead (ppm)

Ranges	%tile	Count
37 - 40	100	(1)
28 - 37	99	(2)
25 - 28	97	(2)
22 - 25	95	(5)
14 - 22	90	(24)
12 - 14	75	(16)
10 - 12	50	(27)
< 10	25	(16)

Till geochemistry, Rideout Island NTS 76 O (N/2)

LEAD

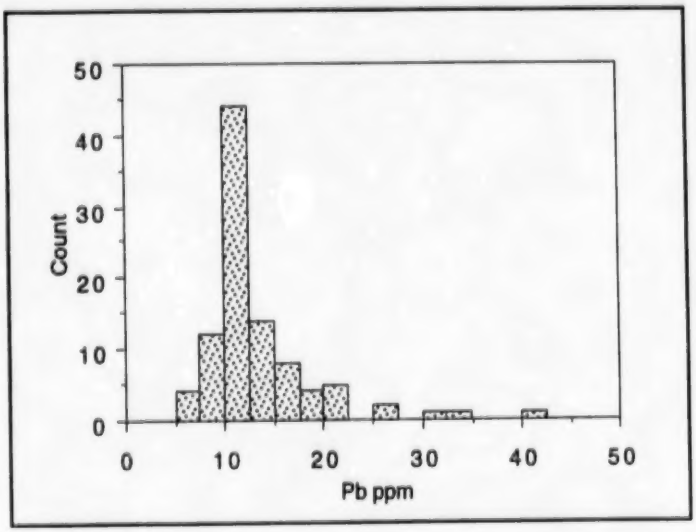
Pb (ppm)

Fraction:	<0.002 mm	Detection limit:	2 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

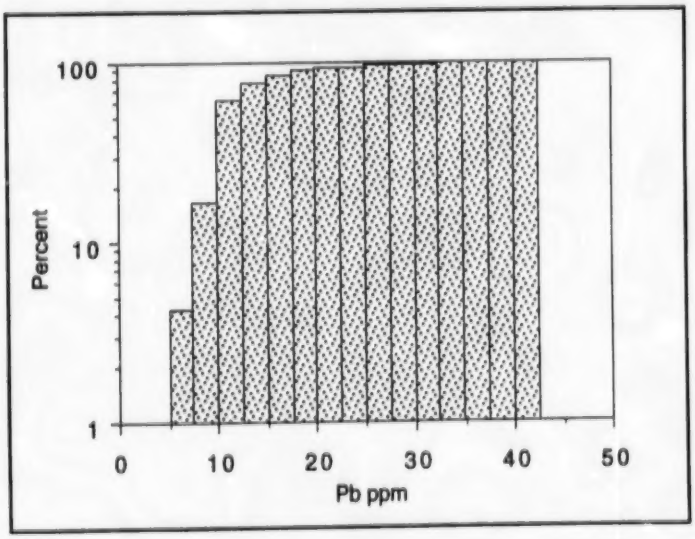
Descriptive Statistics

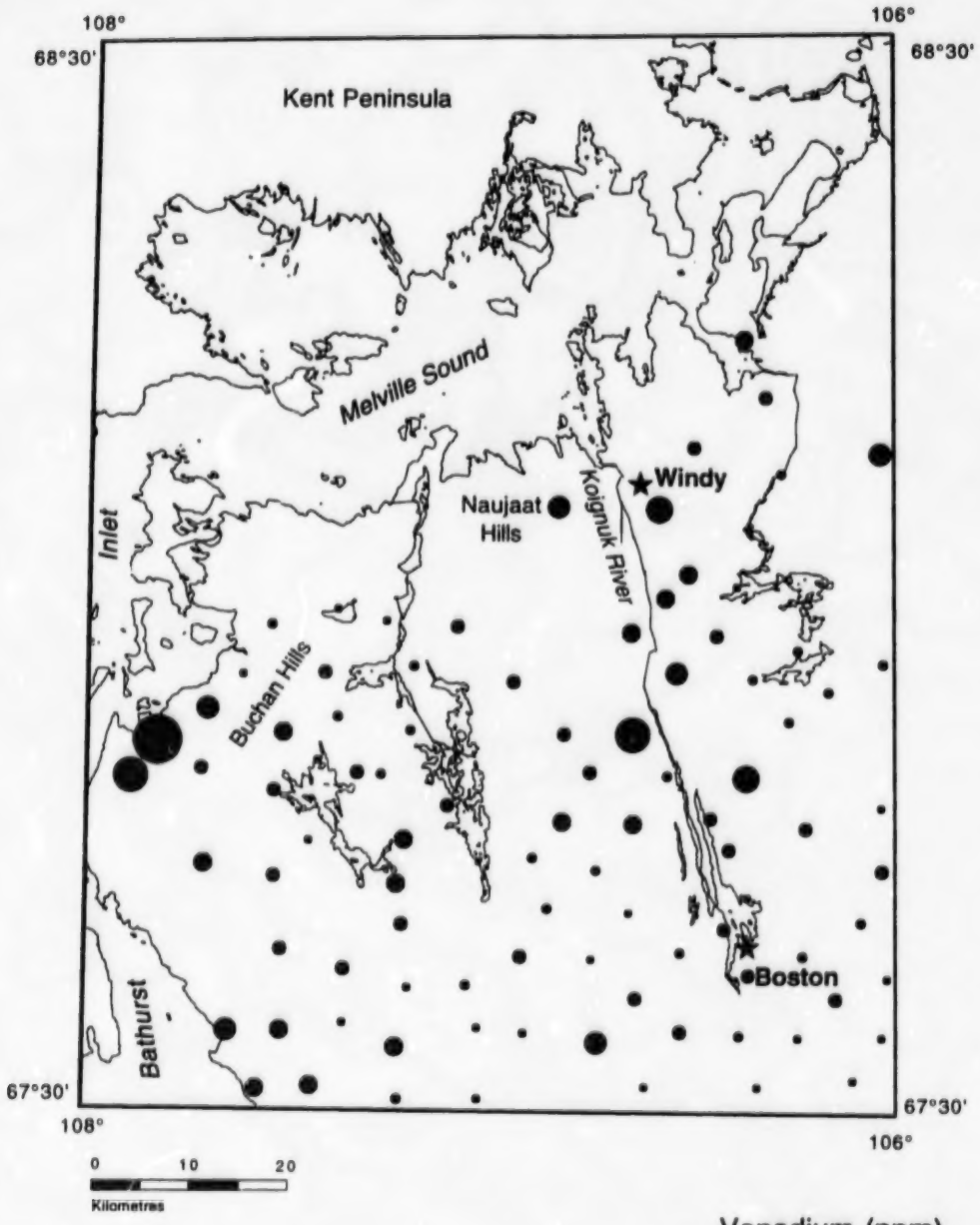
Count:	97
Minimum:	2
Maximum:	40
Mean:	12.95
Median:	12
Mode:	10
St. deviation:	5.84
Coeff. var:	0.45
Geom. mean	11.91
Skewness:	2.01
Kurtosis:	5.55

Frequency Histogram



Cumulative Plot





V

Rideout Island (760)

Vanadium (ppm)

Ranges	%tile	Count
168 - 198	100	(1)
129 - 168	99	(2)
122 - 129	97	(2)
102 - 122	95	(6)
92 - 102	90	(14)
80 - 92	75	(26)
67 - 80	50	(21)
< 67	25	(21)

Till geochemistry, Rideout Island NTS 76 O (N/2)

VANADIUM

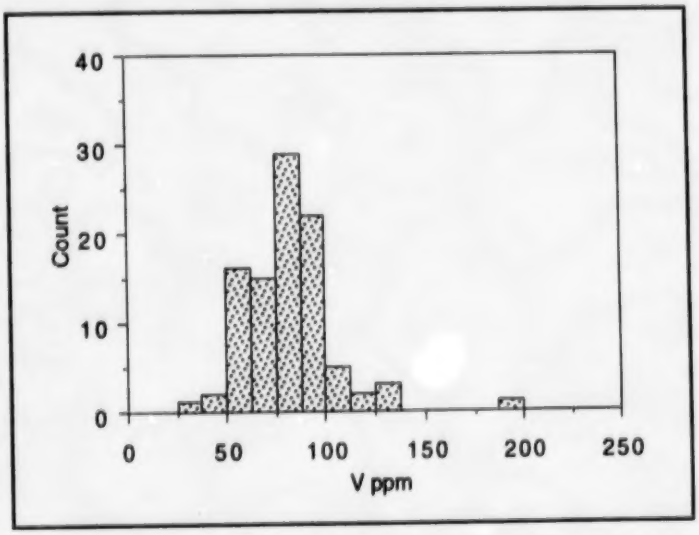
V (ppm)

Fraction:	<0.002 mm	Detection limit:	1 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

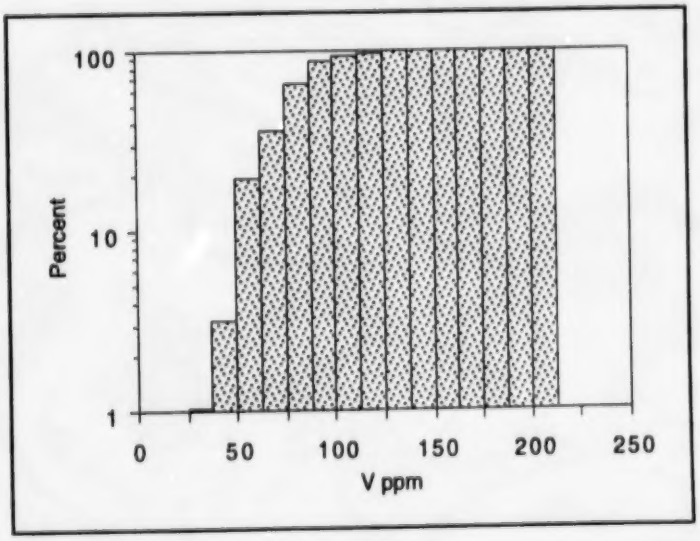
Descriptive Statistics

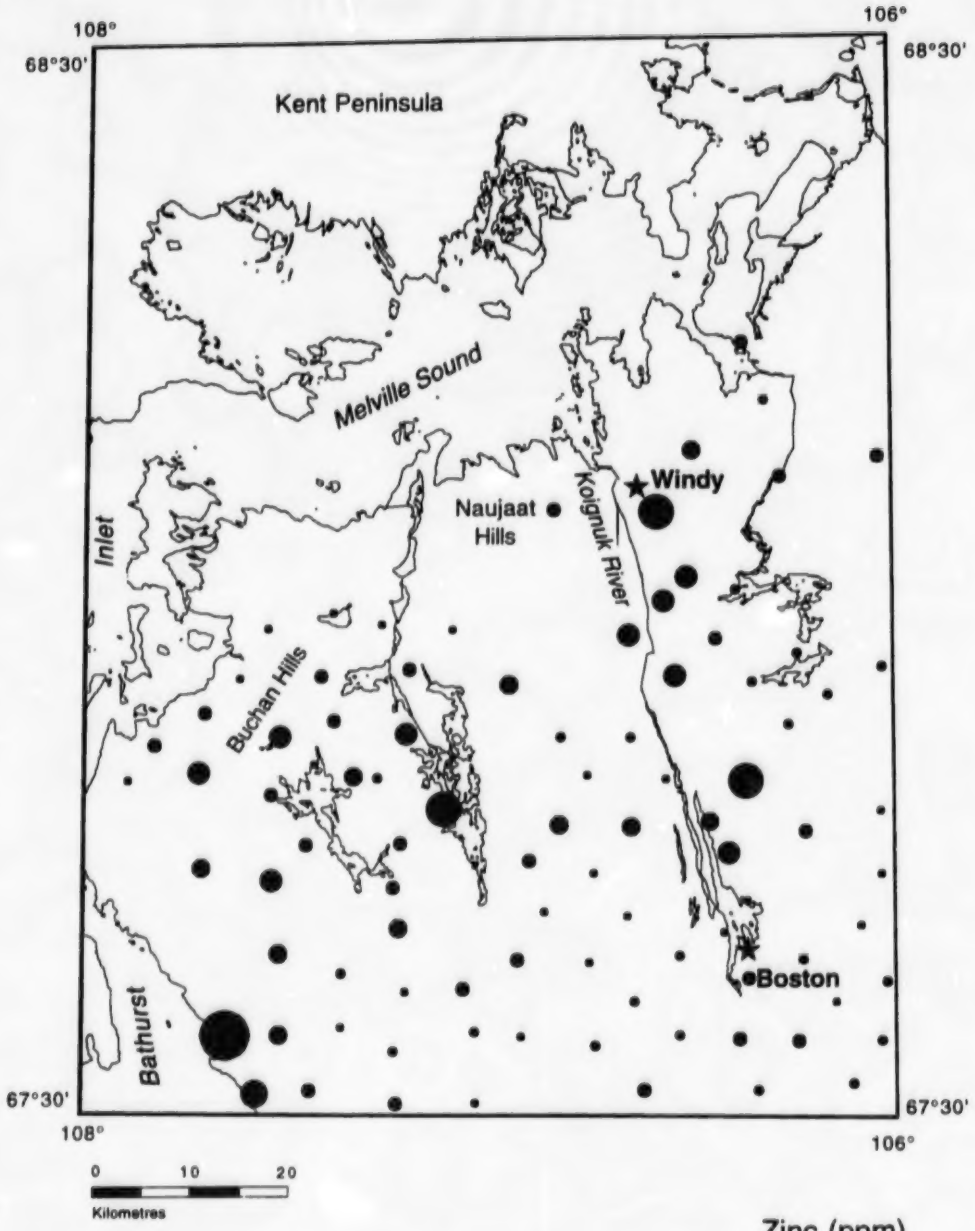
Count:	97
Minimum:	1
Maximum:	198
Mean:	80.38
Median:	80
Mode:	96
St. deviation:	23.67
Coeff. var:	0.29
Geom. mean	74.98
Skewness:	1
Kurtosis:	6.13

Frequency Histogram



Cumulative Plot





Zn

Rideout Island (760)

Zinc (ppm)

Ranges	%tile	Count
163 - 180	100	(1)
138 - 163	99	(3)
133 - 138	97	(1)
126 - 133	95	(9)
118 - 126	90	(10)
84 - 118	75	(24)
67 - 84	50	(22)
< 67	25	(23)

Till geochemistry, Rideout Island NTS 76 O (N/2)

ZINC

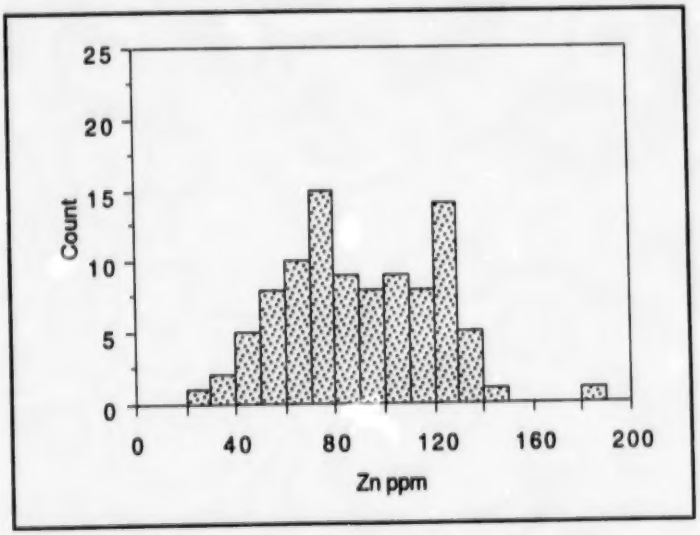
Zn (ppm)

Fraction:	<0.002 mm	Detection limit:	2 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

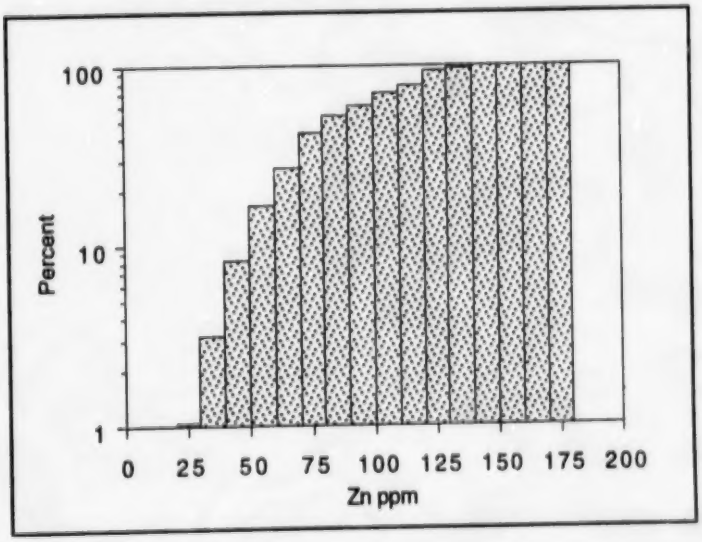
Descriptive Statistics

Count:	97
Minimum:	2
Maximum:	180
Mean:	89.15
Median:	84
Mode:	78
St. deviation:	31.05
Coeff. var:	0.35
Geom. mean	81.55
Skewness:	0.01
Kurtosis:	-0.18

Frequency Histogram



Cumulative Plot



Appendix G. Maps and histograms of element concentration determined by INAA (<0.063 mm fraction)

List of elements for maps and histograms:

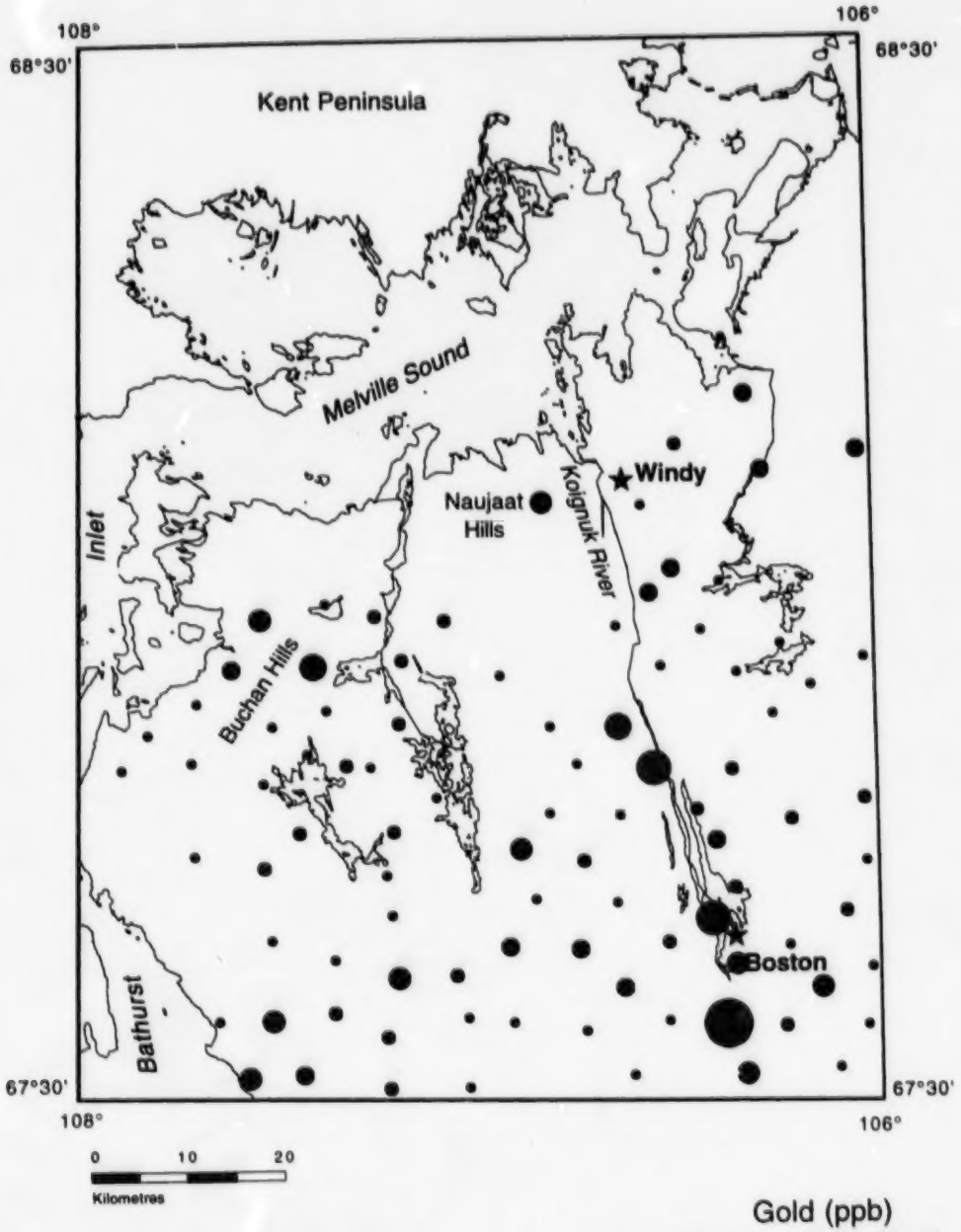
Au
Ba
Ce
Co
Cr
Fe
La
Nd
Rb
Sc

Abbreviations for Descriptive Statistics:

St. deviation = Standard deviation
Coeff. var = Coefficient of variation
Geom. mean = Geometric mean

NOTE: Range values on thematic dot maps range from (example):

30 to < 40
20 to < 30
10 to < 20
0 to < 10



Au

Rideout Island (760)

Gold (ppb)

Ranges	%tile	Count
31 - 42	100	(1)
12 - 31	99	(2)
10 - 12	97	(2)
6 - 10	95	(9)
4 - 6	90	(11)
2 - 4	75	(22)
< 2	50	(46)

Till geochemistry, Rideout Island NTS 76 O (N/2)

GOLD

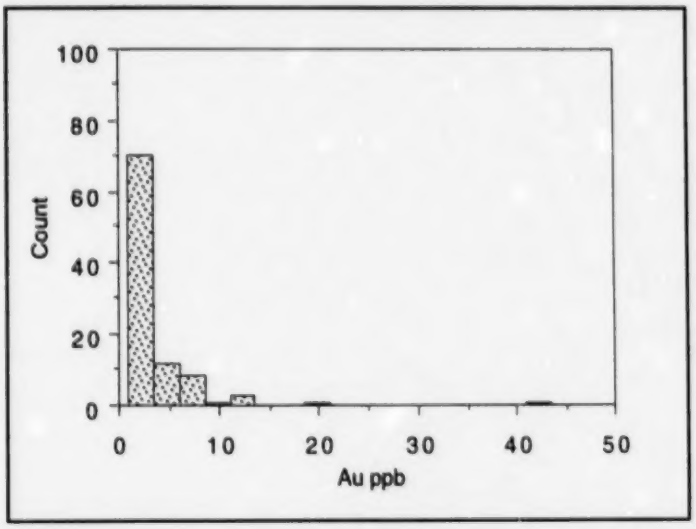
Au (ppb)

Fraction:	<0.063 mm	Detection limit:	2 ppb
Method:	INAA		

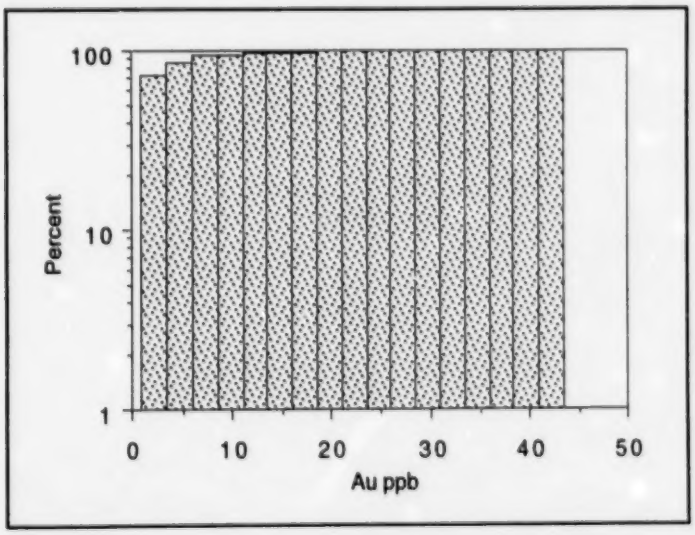
Descriptive Statistics

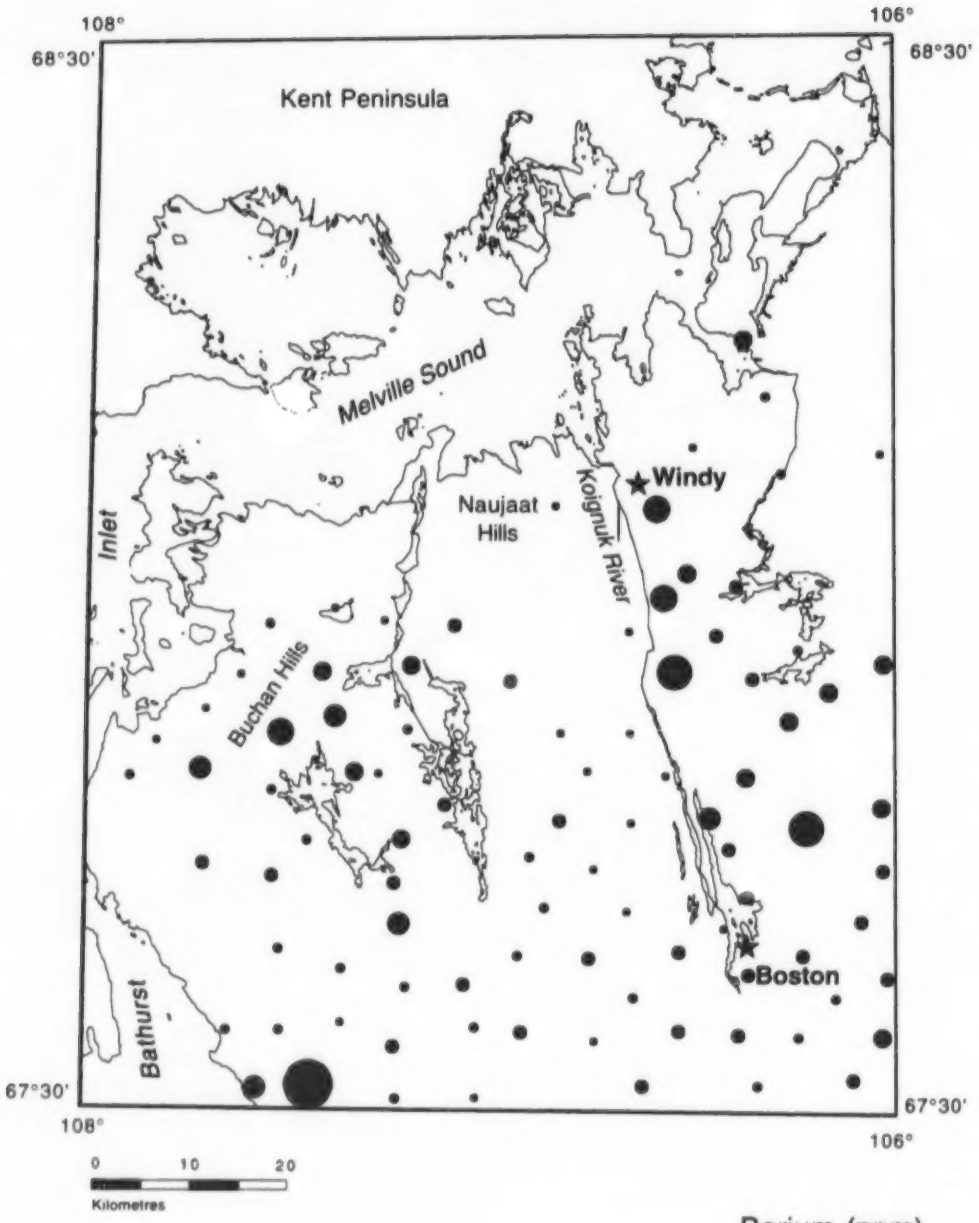
Count:	97
Minimum:	1
Maximum:	42
Mean:	3.31
Median:	2
Mode:	1
St. deviation:	4.97
Coeff. var:	1.5
Geom. mean	2.08
Skewness:	5.42
Kurtosis:	37.06

Frequency Histogram



Cumulative Plot





Ba

Rideout Island (760)

Barium (ppm)

Ranges	%tile	Count
859 - 910	100	(1)
762 - 859	99	(2)
740 - 762	97	(3)
720 - 740	95	(5)
645 - 720	90	(12)
590 - 645	75	(26)
530 - 590	50	(22)
< 530	25	(22)

Till geochemistry, Rideout Island NTS 76 O (N/2)

BARIUM

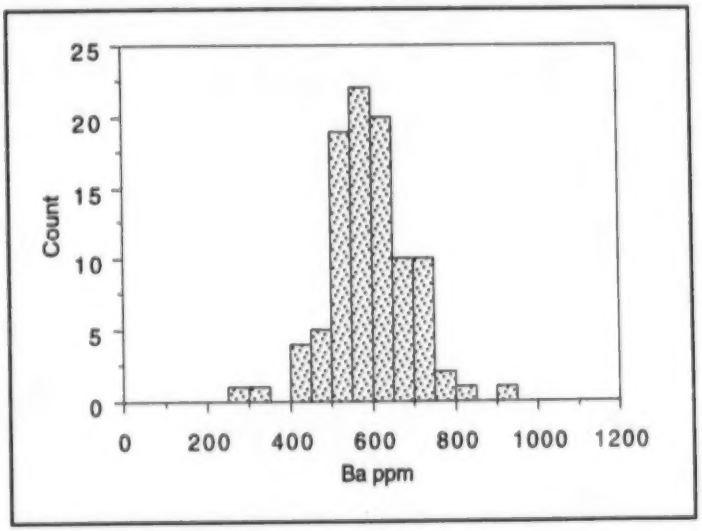
Ba (ppm)

Fraction:	<0.063 mm	Detection limit:	50 ppm
Method:	INAA		

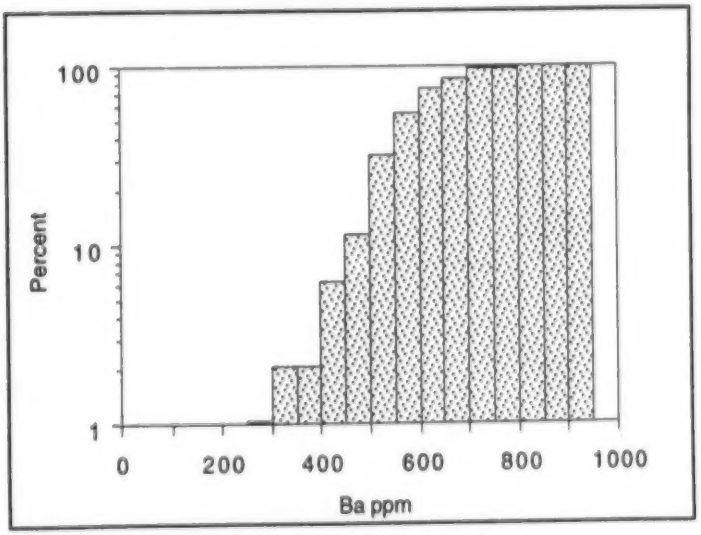
Descriptive Statistics

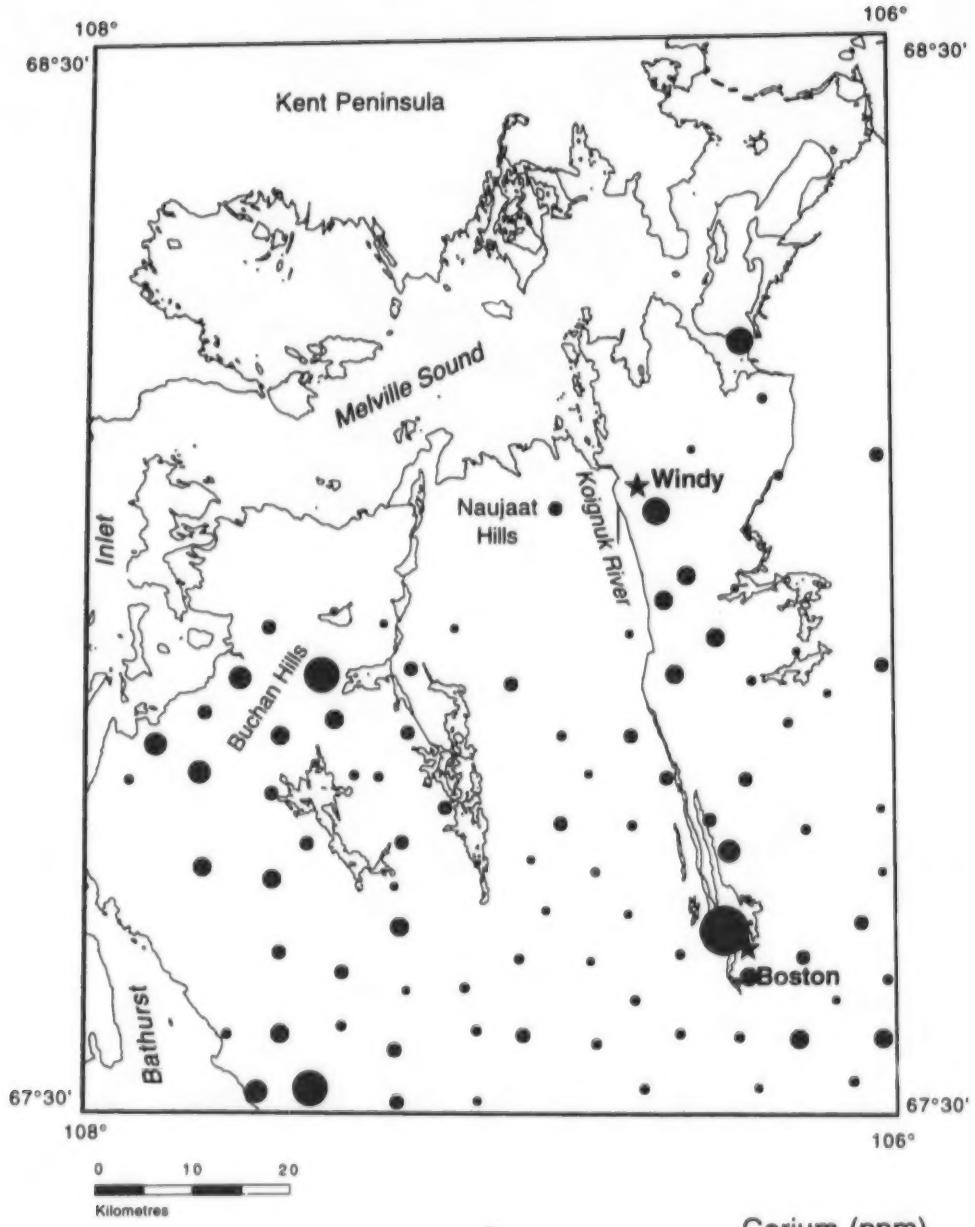
Count:	97
Minimum:	50
Maximum:	910
Mean:	585.05
Median:	590
Mode:	610
St. deviation:	113.88
Coeff. var:	0.19
Geom. mean	566.95
Skewness:	-1.06
Kurtosis:	4.72

Frequency Histogram



Cumulative Plot





Ce

Rideout Island (760)

Cerium (ppm)

Ranges	%tile	Count
167 - 190	100	(1)
122 - 167	99	(2)
107 - 122	97	(2)
96 - 107	95	(5)
75 - 96	90	(13)
65 - 75	75	(24)
56 - 65	50	(24)
< 56	25	(22)

Till geochemistry, Rideout Island NTS 76 O (N/2)

CERIUM

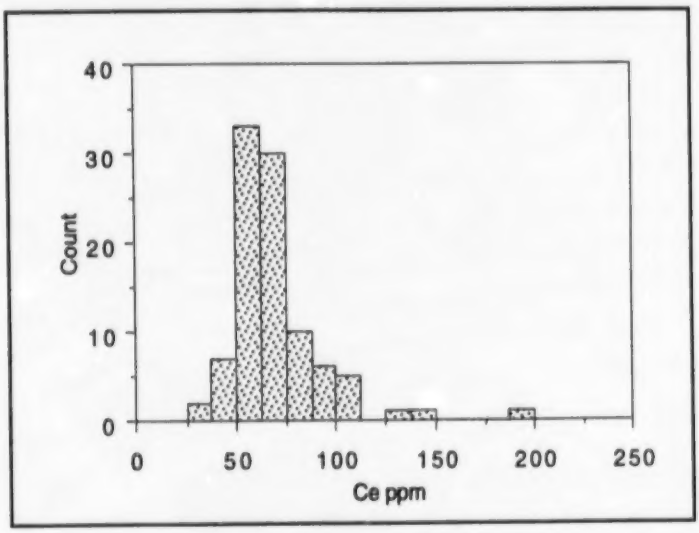
Ce (ppm)

Fraction:	<0.063 mm	Detection limit:	3 ppm
Method:	INAA		

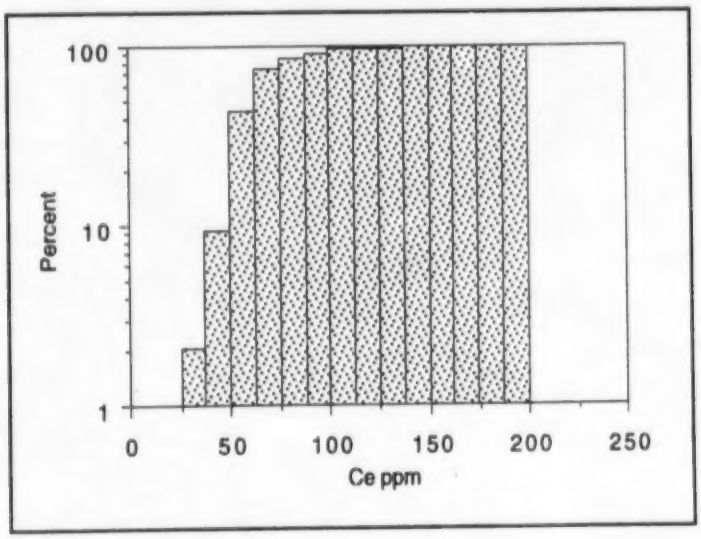
Descriptive Statistics

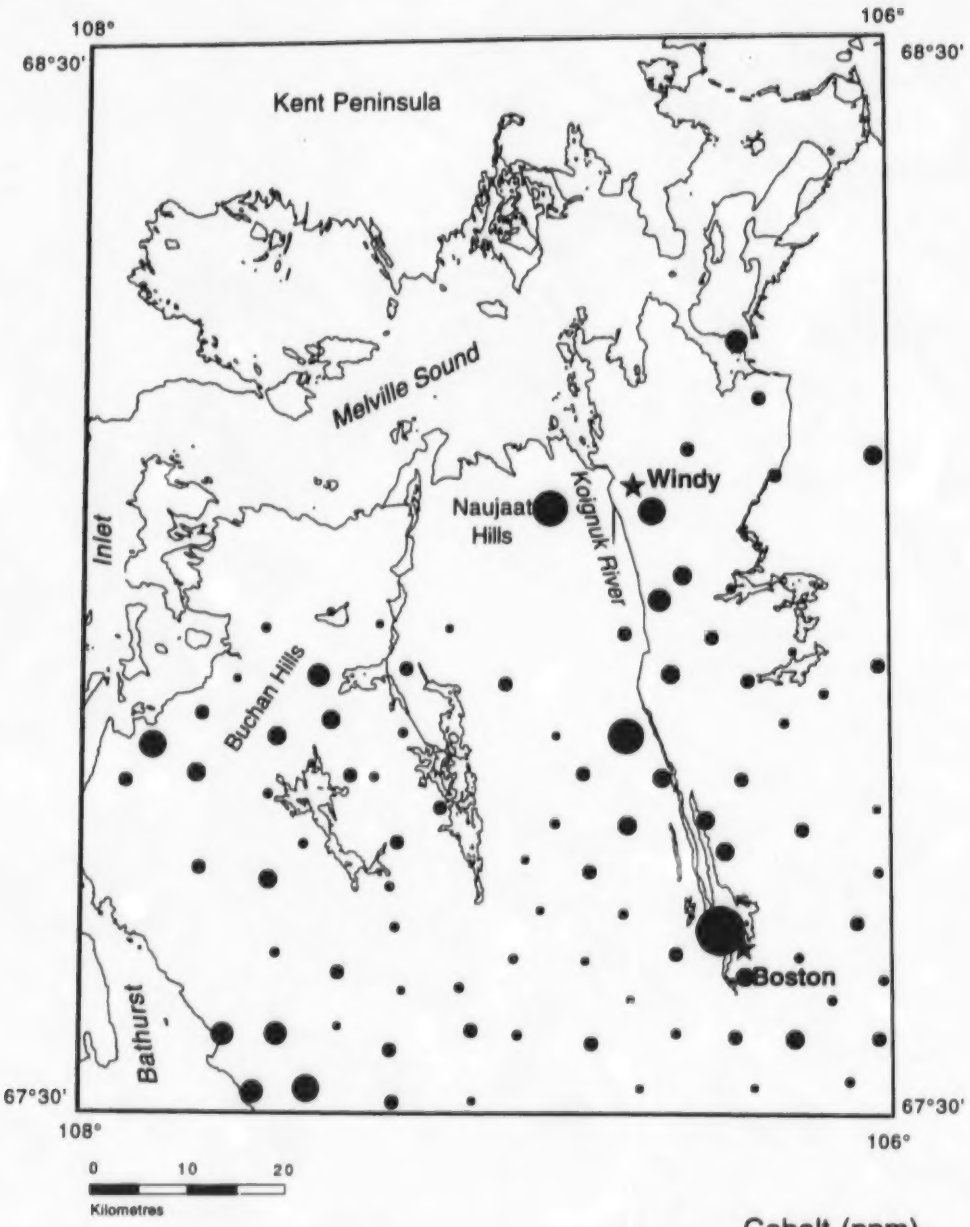
Count:	97
Minimum:	3
Maximum:	190
Mean:	68.82
Median:	65
Mode:	
St. deviation:	22.99
Coeff. var:	0.33
Geom. mean	64.66
Skewness:	1.87
Kurtosis:	8

Frequency Histogram



Cumulative Plot





Co

Rideout Island (760)

Cobalt (ppm)

Ranges	%tile	Count
26 - 29	100	(1)
23 - 26	99	(2)
20 - 23	97	(3)
18 - 20	95	(6)
14 - 18	90	(13)
10 - 14	75	(28)
8 - 10	50	(23)
< 8	25	(17)

Till geochemistry, Rideout Island NTS 76 O (N/2)

COBALT

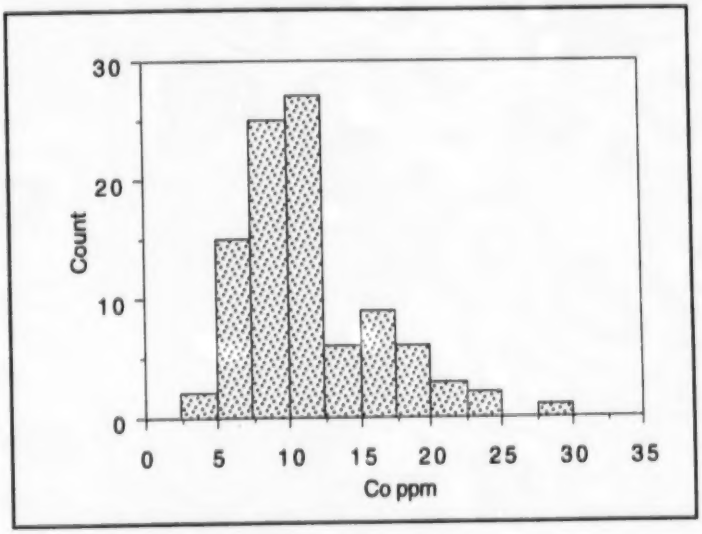
Co (ppm)

Fraction:	<0.063 mm	Detection limit:	1 ppm
Method:	INAA		

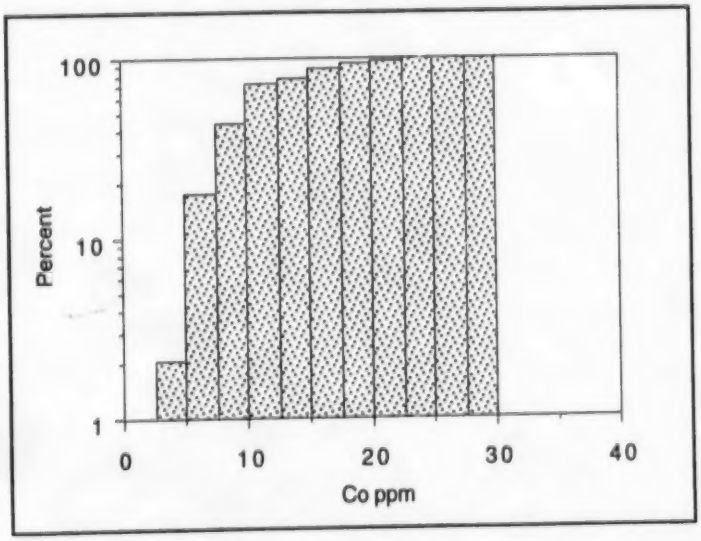
Descriptive Statistics

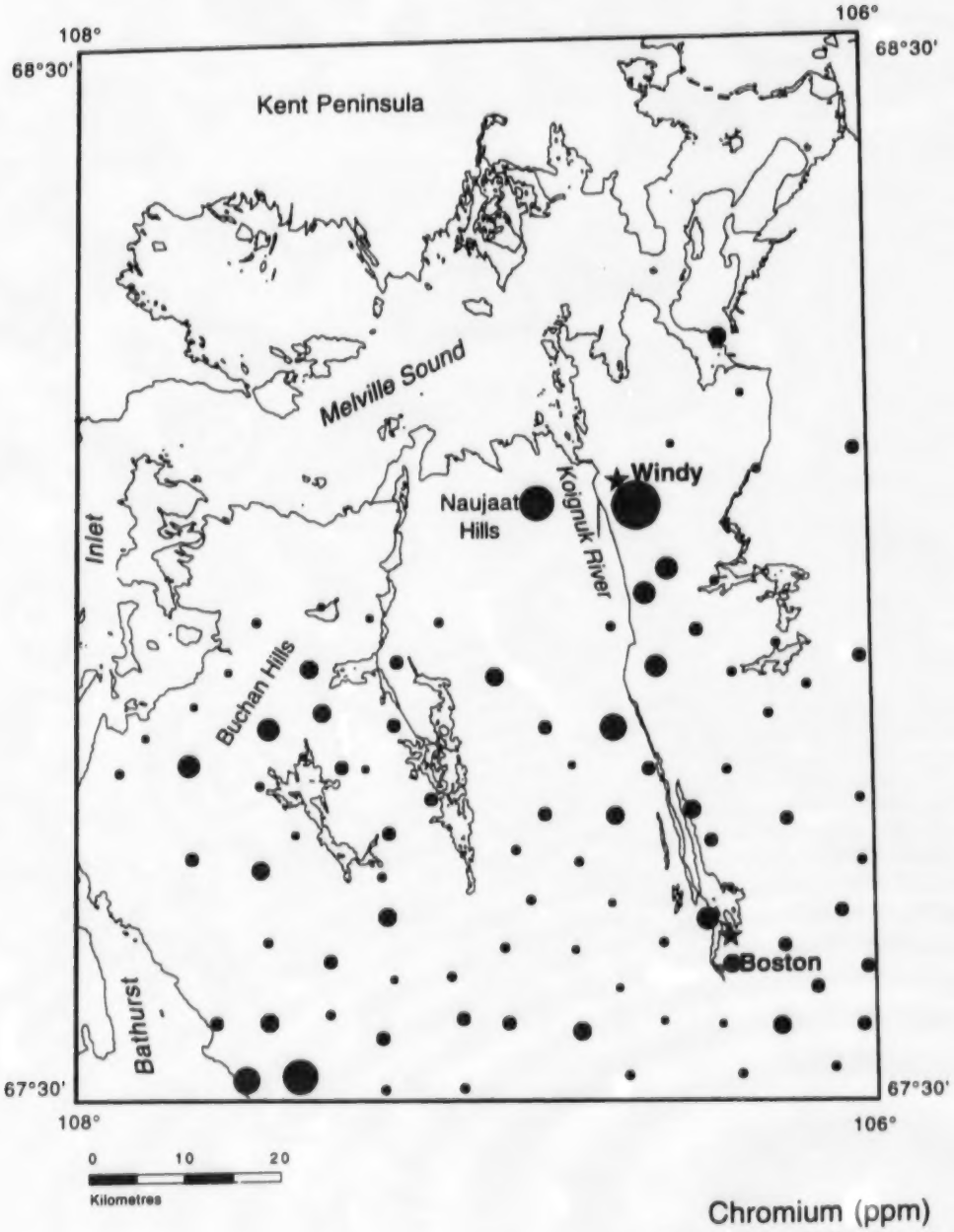
Count:	97
Minimum:	1
Maximum:	29
Mean:	11.18
Median:	10
Mode:	8
St. deviation:	4.75
Coeff. var:	0.43
Geom. mean	10.2
Skewness:	1.1
Kurtosis:	1.39

Frequency Histogram



Cumulative Plot





Cr

Rideout Island (760)

Chromium (ppm)

Ranges	%tile	Count
151 - 160	100	(1)
116 - 151	99	(2)
93 - 116	97	(2)
87 - 93	95	(6)
65 - 87	90	(12)
54 - 65	75	(24)
47 - 54	50	(28)
< 47	25	(18)

Till geochemistry, Rideout Island NTS 76 O (N/2)

CHROMIUM

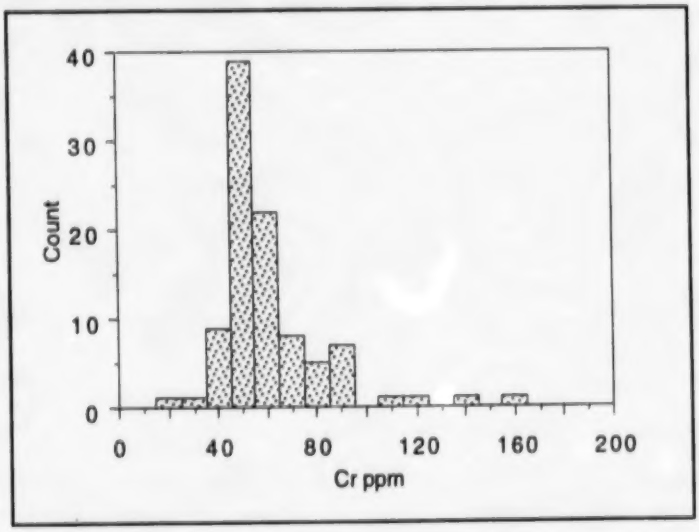
Cr (ppm)

Fraction:	<0.063 mm	Detection limit:	5 ppm
Method:	INAA		

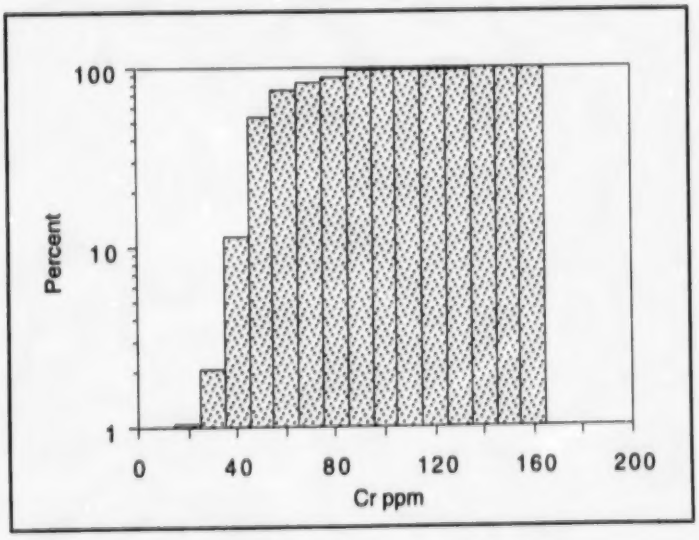
Descriptive Statistics

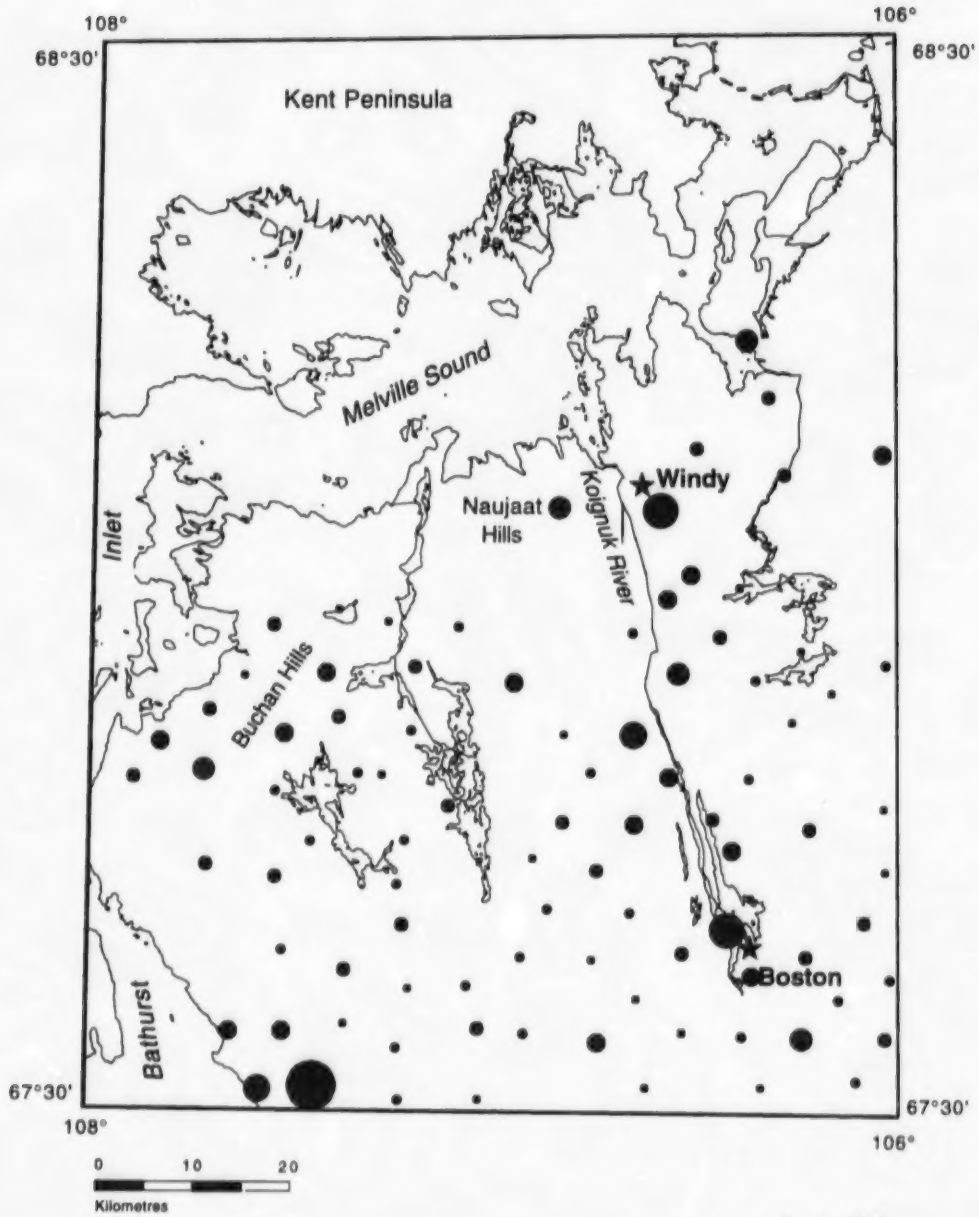
Count:	97
Minimum:	5
Maximum:	160
Mean:	59.6
Median:	53
Mode:	62
St. deviation:	21.57
Coeff. var:	0.36
Geom. mean	55.92
Skewness:	1.84
Kurtosis:	5.95

Frequency Histogram



Cumulative Plot





Fe

Rideout Island (760)

Iron (%)

Ranges	%tile	Count
5.68 - 5.92	100	(1)
4.33 - 5.68	99	(2)
4.09 - 4.33	97	(2)
3.83 - 4.09	95	(5)
3.1 - 3.83	90	(14)
2.6 - 3.1	75	(23)
2.29 - 2.6	50	(24)
< 2.29	25	(22)

Till geochemistry, Rideout Island NTS 76 O (N/2)

IRON

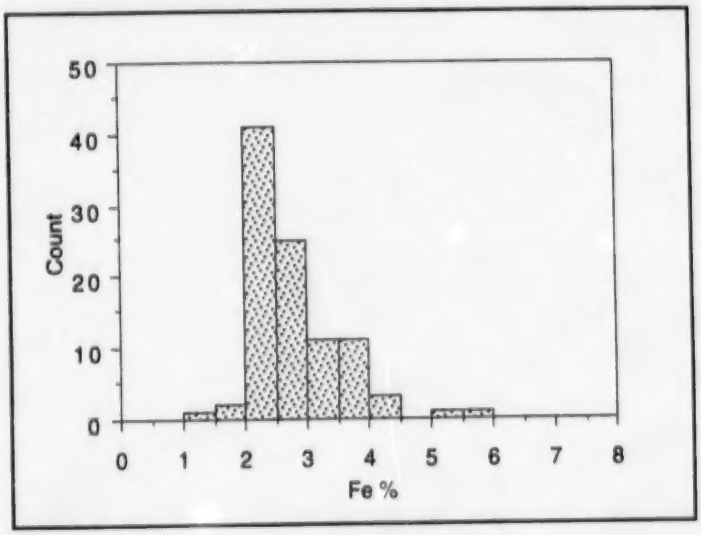
Fe (%)

Fraction:	<0.063 mm	Detection limit:	0.01%
Method:	INAA		

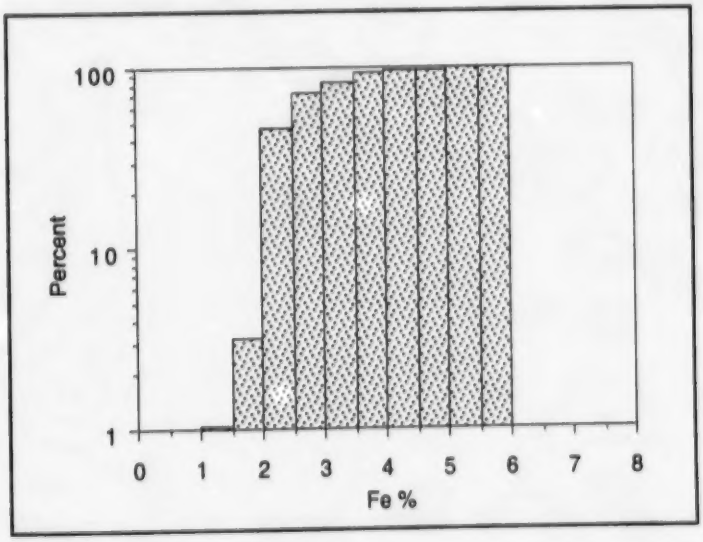
Descriptive Statistics

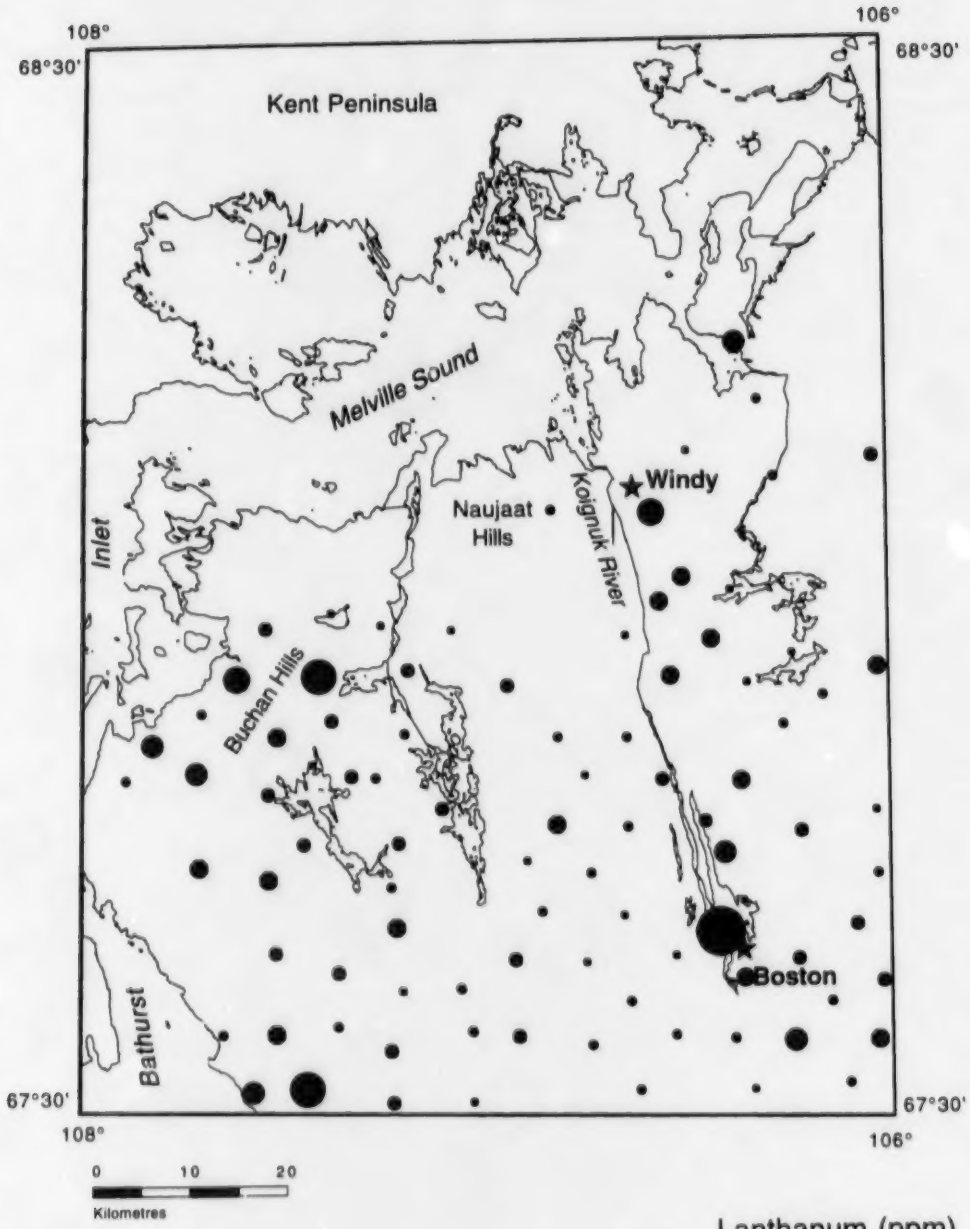
Count:	97
Minimum:	0.01
Maximum:	5.92
Mean:	2.76
Median:	2.59
Mode:	
St. deviation:	0.8
Coeff. var:	0.29
Geom. mean	2.55
Skewness:	0.85
Kurtosis:	3.4

Frequency Histogram



Cumulative Plot





La

Rideout Island (760)

Lanthanum (ppm)

Ranges	%tile	Count
90 - 100	100	(1)
68 - 90	99	(2)
55 - 68	97	(2)
50 - 55	95	(6)
38 - 50	90	(14)
33 - 38	75	(22)
28 - 33	50	(27)
< 28	25	(19)

Till geochemistry, Rideout Island NTS 76 O (N/2)

LANTHANUM

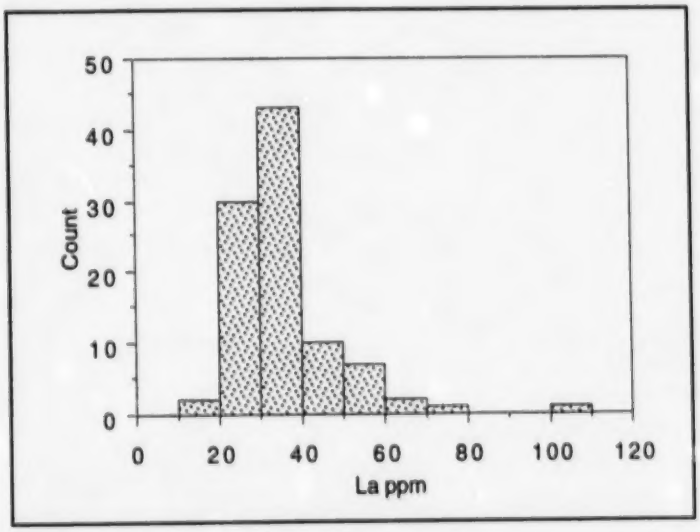
La (ppm)

Fraction:	<0.063 mm	Detection limit:	0.5 ppm
Method:	INAA		

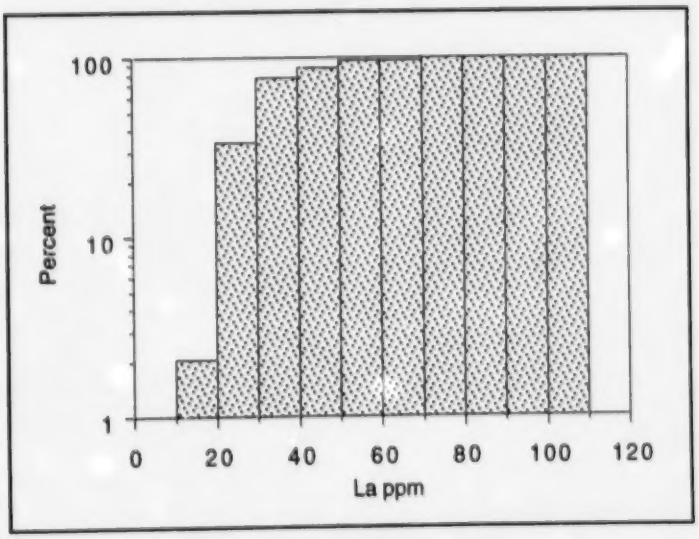
Descriptive Statistics

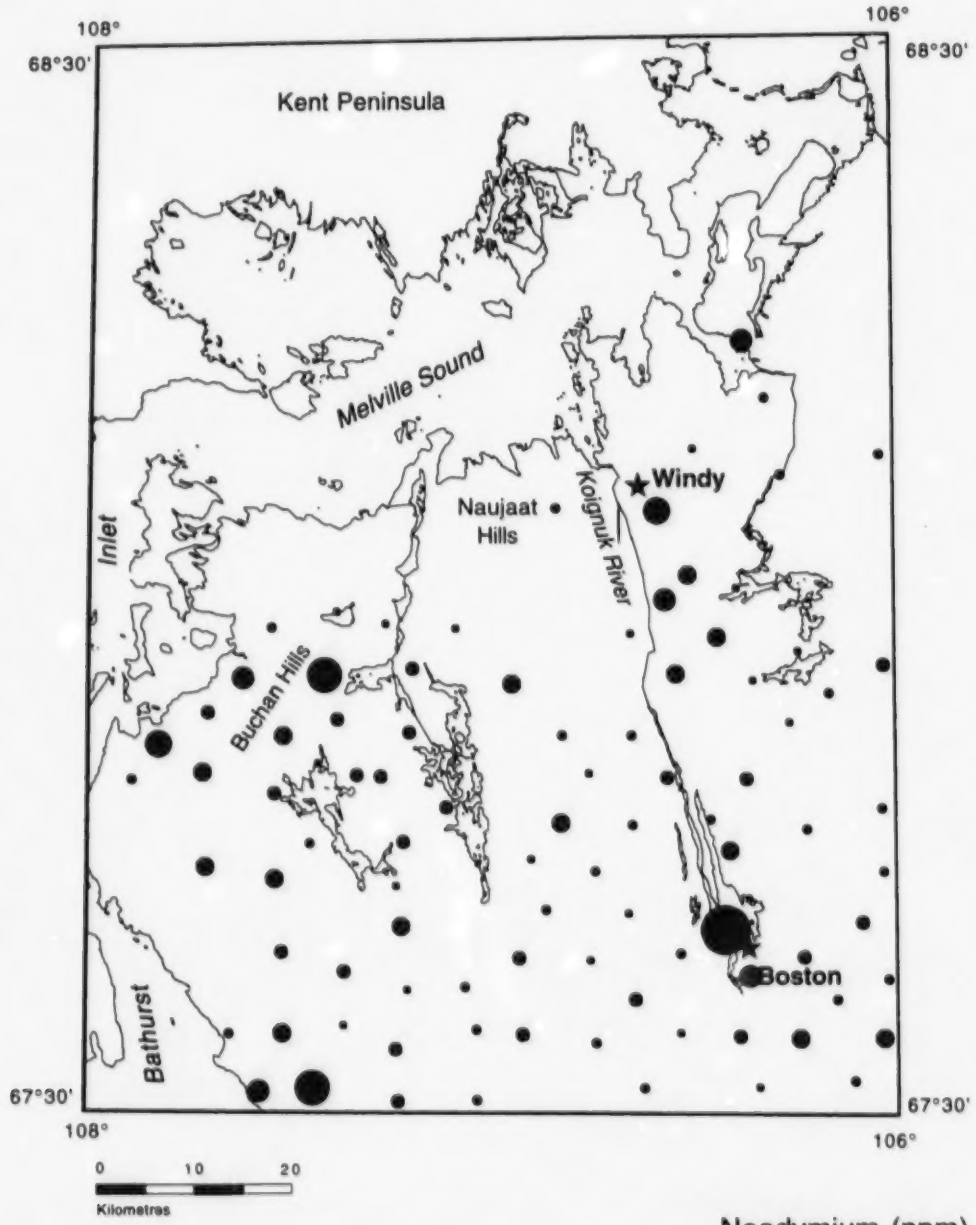
Count:	97
Minimum:	0.5
Maximum:	100
Mean:	35.08
Median:	33
Mode:	31
St. deviation:	12.81
Coeff. var:	0.37
Geom. mean	32.37
Skewness:	1.95
Kurtosis:	7.29

Frequency Histogram



Cumulative Plot





Nd

Rideout Island (760)

Neodymium (ppm)

Ranges	%tile	Count
61 - 66	100	(1)
51 - 61	99	(2)
41 - 51	97	(2)
38 - 41	95	(5)
32 - 38	90	(14)
27 - 32	75	(22)
23 - 27	50	(27)
< 23	25	(20)

Till geochemistry, Rideout Island NTS 76 O (N/2)

NEODYMIUM

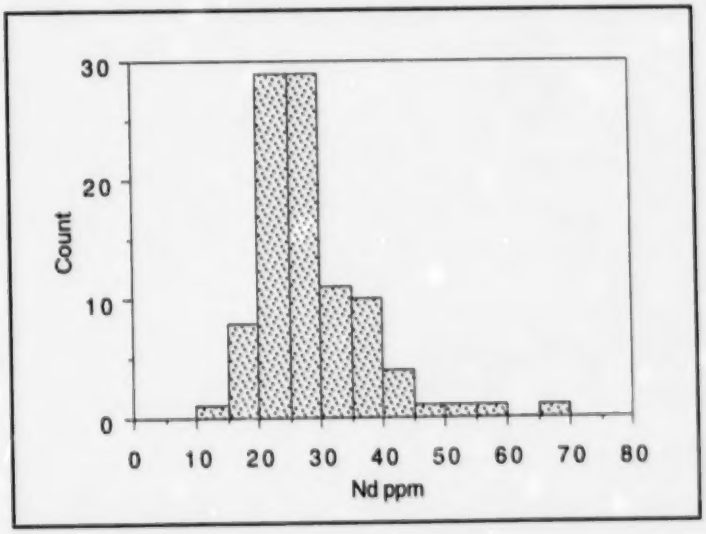
Nd (ppm)

Fraction:	<0.063 mm	Detection limit:	5 ppm
Method:	INAA		

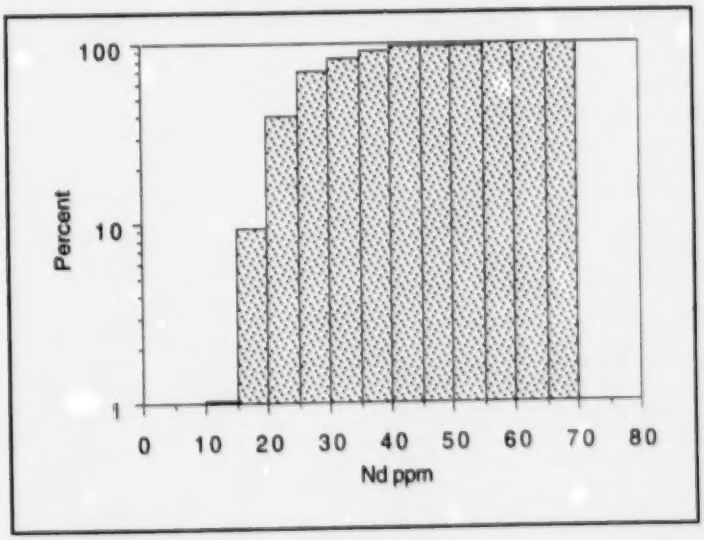
Descriptive Statistics

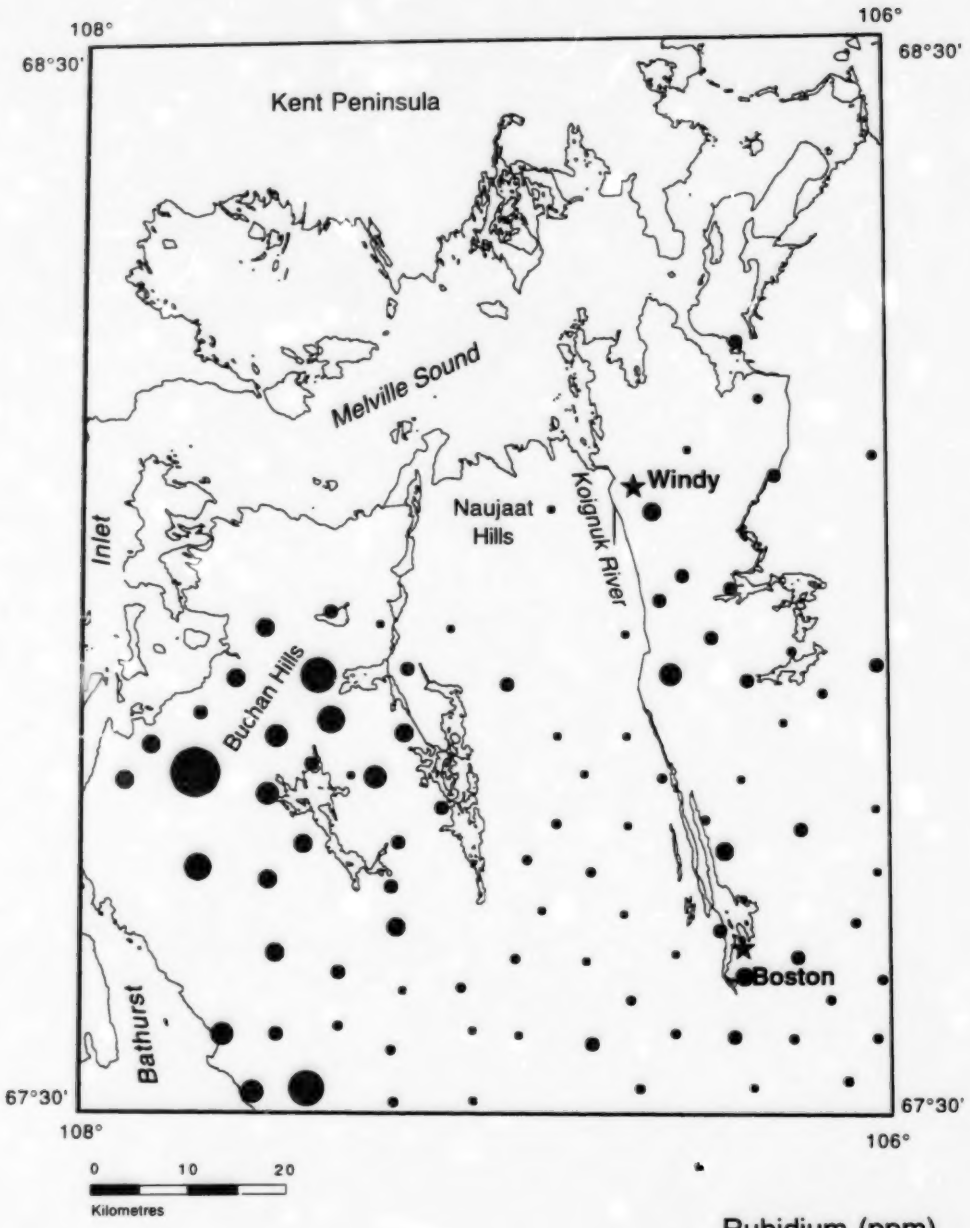
Count:	97
Minimum:	5
Maximum:	66
Mean:	27.76
Median:	26
Mode:	23
St. deviation:	8.84
Coeff. var:	0.32
Geom. mean	26.43
Skewness:	1.34
Kurtosis:	3.85

Frequency Histogram



Cumulative Plot





Rb

Rideout Island (760)

Rubidium (ppm)

Ranges	%tile	Count
145 - 150	100	(1)
126 - 145	99	(2)
117 - 126	97	(2)
100 - 117	95	(6)
82 - 100	90	(12)
62 - 82	75	(23)
51 - 62	50	(23)
< 51	25	(24)

Till geochemistry, Rideout Island NTS 76 O (N/2)

RUBIDIUM

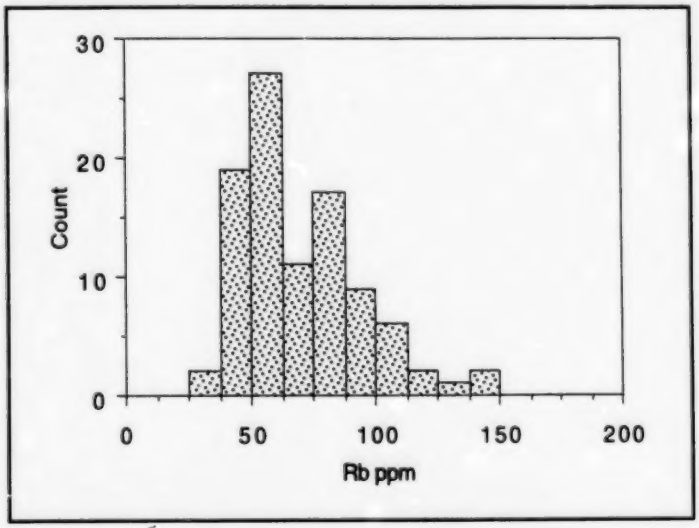
Rb (ppm)

Fraction:	<0.063 mm	Detection limit:	5 ppm
Method:	INAA		

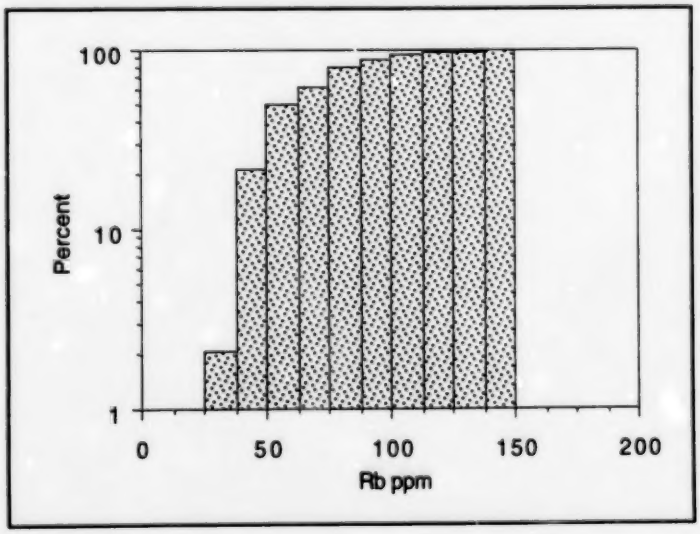
Descriptive Statistics

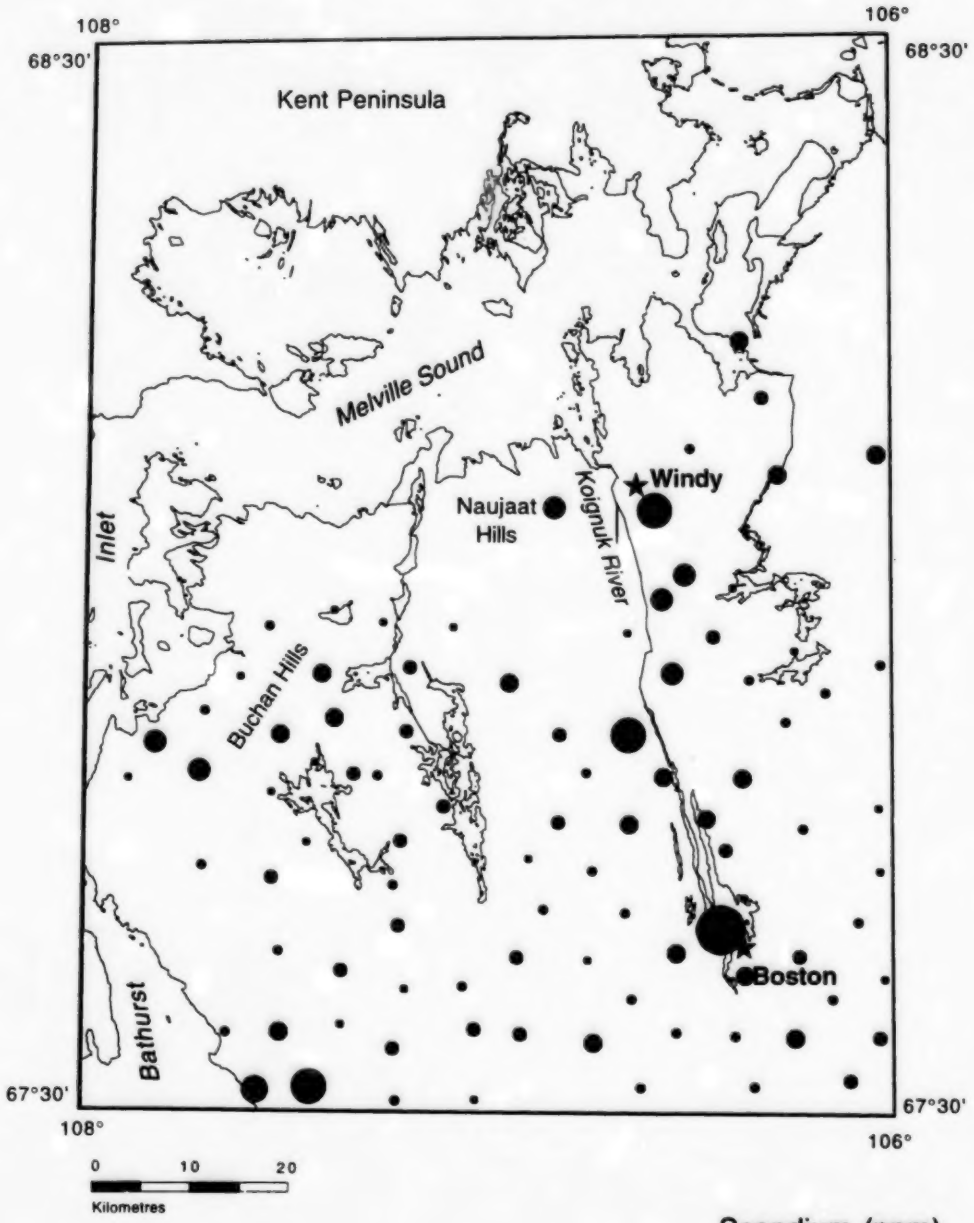
Count:	97
Minimum:	15
Maximum:	150
Mean:	68.42
Median:	61
Mode:	
St. deviation:	24.88
Coeff. var:	0.36
Geom. mean	64.19
Skewness:	0.92
Kurtosis:	0.77

Frequency Histogram



Cumulative Plot





Sc

Rideout Island (760)

Scandium (ppm)

Ranges	%tile	Count
16.5 - 17	100	(1)
16 - 16.5	99	(3)
13.7 - 16	97	(1)
13 - 13.7	95	(6)
11 - 13	90	(16)
9.8 - 11	75	(20)
9 - 9.8	50	(26)
< 9	25	(20)

Till geochemistry, Rideout Island NTS 76 O (N/2)

SCANDIUM

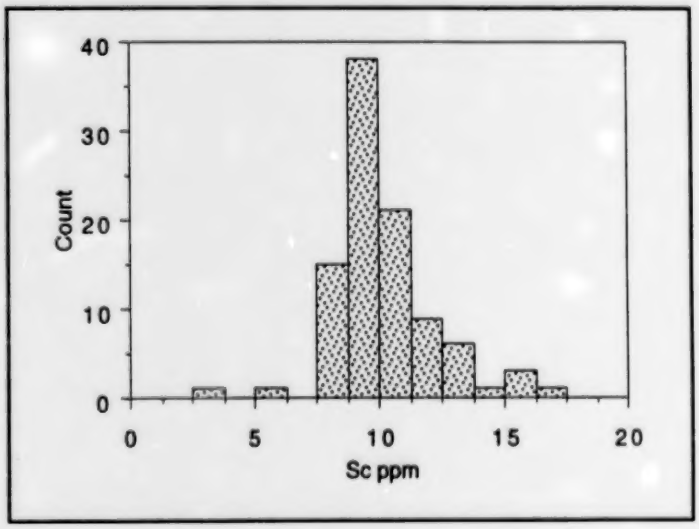
Sc (ppm)

Fraction:	<0.063 mm	Detection limit:	0.1 ppm
Method:	INAA		

Descriptive Statistics

Count:	97
Minimum:	0.1
Maximum:	17
Mean:	10
Median:	9.7
Mode:	10
St. deviation:	2.28
Coeff. var:	0.23
Geom. mean	9.44
Skewness:	-0.14
Kurtosis:	4.42

Frequency Histogram



Cumulative Plot